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January 11. 173¾.

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OR,
ARCHITECT'S Companion.

Explaining not only the

TERMS of ART

In all the ſeveral

PARTS of ARCHITECTURE,

But alſo containing the

THEORY and PRACTICE

Of the various

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VOL. II.

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M.DCC.XXXIV.

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MDCCXXXIV.

THE NEW BUILDER'S *Dictionary*:

OR,

Gentleman's *and* Architect's COMPANION.

JAMBS } [in *Carpentry*] JAUMS } Door-Posts, also the upright Posts at the Ends of Window Frames.

JAMBS } [with *Bricklayers* JAUMS } &c.] the upright Sides of Chimneys, from the Hearth to the Mantle-Tree.

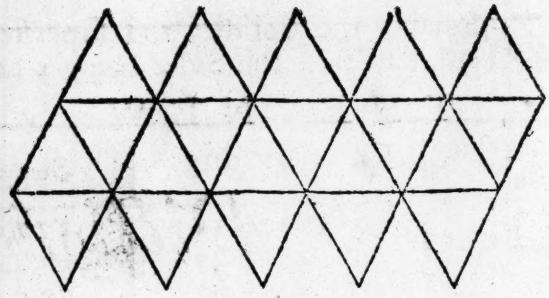
The Word is *Jambe* in *French* and signifies a Leg.

ICHNOGRAPHY [in *Architecture*] a Description or Draught of the Plat-Form or Ground-Work of a House or other Building. Or it is the Geometrical Place or Plat-Form of an Edifice or the Ground-Plot of an House or Building delineated upon Paper, describing the Form of the several Apartments, Rooms, Windows, Chimneys, &c. And this is properly the Business of the Master Architect or Surveyor, being indeed the most abstruse and difficult of any.

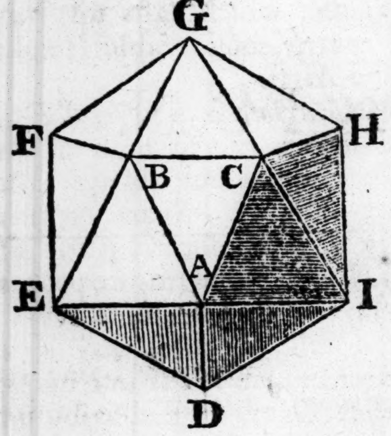
ICHNOGRAPHY [in *Perspective*] is the View of any Thing cut off, by a Plane parallel to the Horizon, just at the Base or Bottom of it.

ICOSIHEDRON is a Solid Body contain'd under 20 equal and equilateral Triangles. Or,

ICOSIHEDRON is a Solid, which consists of 20 triangular Pyramids, whose Vertices meet in the Centre of a Sphere, which is imagined to circumscribe it; and therefore have their Height and Bases equal. Wherefore the Solidity of one of these Pyramids being multiplyed by 20, the Number of Bases, gives the solid Content of the Icosihedron.



This Figure being drawn in Past-Board, cut half through and then folded up neatly together, will represent an *Icosihedron.*



Let A B C D E F G H I, be an Ichosihedron, each Side of which is 12 Inches; the solid and superficial Content is requir'd.

The Icosihedron is compos'd of 20 triangular Pyramids, with their Vertices all joining in the Centre.

Therefore if the Solid Content of one Pyramid be multiply'd by 20, the Product is the whole Solid Content of the Icosihedron.

```
  10 . 39224
           6
 -----------
  62 . 35344
          20
 -----------
1247 - 06880
```

The third Part of the Altitude of the Pyramid.

```
  30230456
   4435326
 ---------
 181382736
   6046091
    906914
    151152
      9069
      1209
       121
 ---------
188 - 497292
          20
 -----------
3769 - 945840
```

The Solidity.

The superficial Content 1147 - 0688.

A TABLE ſhewing the Solidity and ſuperficial Content of any of the Regular Bodies, the Sides being 1 or Unity.

The Names of the Bodies	The Solidity	Superficies
Tetrahedron	0 - 1178511	1 · 732051
Octahedron	0 - 4714045	3 · 464102
Hexahedron	1 0000000	6 · 000000
Icoſihedron	2 - 181695	8 · 660254
Dodecahedron	7 - 663119	20 · 645.729

By this Table the Content either Superficial or Solid, of any of theſe Bodies, may very readily be found; for all like Superficial Figures, are in Proportion one to another, as are the Squares of their like Sides; therefore it will be as the Square of 1 (which is 1) is to the Superficial Content in the Table, ſo is the Square of the Side of the like Body, to the Superficial Content of the ſame Body.

Therefore, if the Number in the Table be multiply'd by the Square of the Side given, the Product will be the Superficial Content requir'd.

All like Solids are in ſuch Proportion to each other, as are the Cubes of their like Sides; therefore it will be as 1. (which is the Cube of 1.) is to the Solid Content in the Table, ſo is the Cube of the Side given to the Solid Content requir'd.

Therefore if the Number in the Table be multiply'd by the Cube of the given Side, the Product will be the Solid Content of the ſame Body.

JET D'EAU is a *French* Term, commonly us'd for a Fountain, which caſts up Water to any conſiderable Height in the Air.

M. *Mariote* ſays a *Jet d'Eau* will never riſe ſo high as its Reſervatory; but always falls ſhort of it by a Space, which is in a ſubduplicate Ratio of that Height; and this he proves by ſeveral Experiments.

He tells us alſo, that if a greater Branch is cut into many ſmaller Ones, or is diſtributed thro' ſeveral *Jets*, the Square of the Diameter of the main Pipe, muſt be proportioned to the Sum of all the Expences of its Branches, and particularly, that if the Reſervatory be 52 Foot high, and the Adjutage half an Inch in Diameter, the Pipe ought to be 3 Inches in Diameter.

IMAGE [in *Opticks*] is the Appearance of an Object by Reflection or Refraction.

In all Plane Speculums, the Image appears of the ſame Magnitude as the Object, and as far behind the Speculum, as the Object is diſtant before it.

In Convex Speculums, the Image is farther distant from the Centre of the Convexity, than from the Point of Reflection, and the Image appears less than the Object.

IMPASTATION [in *Masonry*] a Term us'd for a Work made of Stuck or Stone, beaten and wrought up in Manner of a Paste.

IMPERFECT Numbers [in *Arithmetick*] are those whose Aliquot Parts taken together, don't make the just Number: but either come short of it, in which Case they are called *deficient Numbers*, or exceed it, and in this Case call'd *Abundant Numbers*.

IMPOSTS [in *Architecture*] are what are sometimes call'd Chaptrels; being the Parts on which the Feet of Arches stand.

These *Imposts* are conformable to their proper Orders.

The *Tuscan* has only a *Plinth*; the *Dorick* has 2 Faces crown'd: the *Jonick* a Larmier or Crown over the two Faces, and its Mouldings may be carved; the *Corinthian* and *Composite* have a Larmier Freeze, and other Mouldings.

The Projectures of the *Imposts* must not exceed the naked of the Pilaster.

Sometimes the Entablature of the Order, serves for the *Impost* of the Arch, and this has a very grand and stately Appearance.

The *Impost* is a Thing very essential to the Composition of the Ordonnances, insomuch that without it, in the Place where the Curve Line of the Arch meets with the perpendicular Line of the Pillar, there always seems a kind of Elbow.

Mr. *Perrault* defines it the *Plinth of a little Cornish*, that crowns a Peer, and supports the first Stone, whence a Vault or Arch commences.

It derives its Name from the *Italian* Imposto, surcharg'd or burthen'd with, or laid upon.

M. *Le Clerc* defines Imposts to be little Cornishes, which terminate the Piedroits of Portico's, and are peculiarly appointed to receive the Extremes of their Arches, with their Archivolts or Head-Bands.

He tells us he usually proposes 2 Designs of Imposts, different in Height and Projecture; the lowest is for Portico's where the Columns have no Pedestals, and the other for Portico's where they have; that is, the little Imposts are for little Arches, and the large Imposts for large Ones; it being highly reasonable, that the Bigness of the Impost should be proportionable to that of the Portico.

He likewise observes, that Care must be taken that the Impost never exceed the Semi-Diameter of the Column behind; nor intercept any Thing of its roundness before.

He adds that the most perfect Arches of the *Jonick* Order, are those which consist of a Semi-Circle; and the Imposts are most usually plac'd on a Level with the Centre.

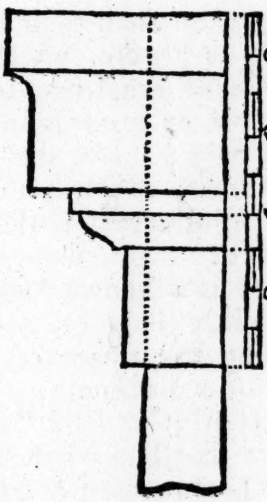
However there are some Architects, who from an optical Consideration, place them a few

Minutes

Minutes lower; and 'tis with Judgment they do it; for as the Projecture of the Impost hides a little Part of the Arch from the Eye, 'tis but reasonable, that it should be lower'd a little, to leave the intire Semi-Circle in View, which otherwise would not appear in View.

Some late Authors have given the following Rules for dividing the *Imposts* of *Arches*, by the Proportions of equal Parts; any Height being given (for either of them) is divided into Nine Parts.

In the *Tuscan* Impost,

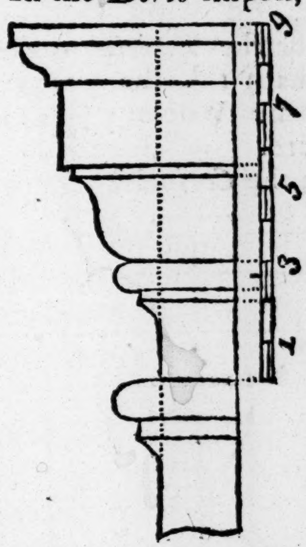


he Facia or Band hath 3, the Ogee 1, the Fillet $\frac{1}{2}$ a Part, he Corona 3, and the Band $\frac{1}{2}$.

For the *Projections*, the Faia hath $\frac{1}{2}$ a Part, the Ogee 2, he Corona 3, and the whole $\frac{1}{2}$. As in the Figure.

I M

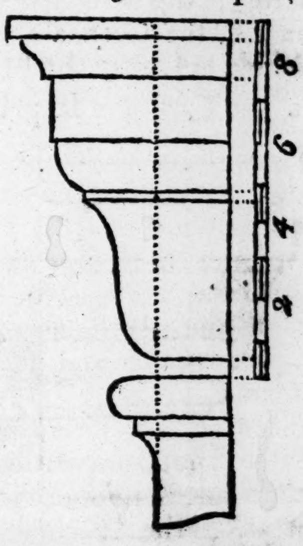
In the *Doric* Impost,



the Frize is 2, the Fillet $\frac{1}{4}$; the Astragal $\frac{3}{4}$, the Scima Recta 2 $\frac{1}{4}$, the Fillet $\frac{1}{4}$, the Corona 2, the Ogee 1, and the Fillet $\frac{1}{2}$ a Part.

For the *Projections*, the Fillet hath $\frac{1}{2}$ a Part, the Astragal 1, the Corona 2 $\frac{1}{2}$, and the Whole 3 $\frac{1}{2}$. As in the Figure.

In the *Jonic* Impost,



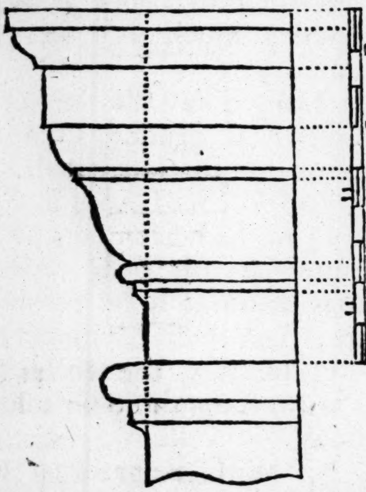
the Fillet hath $\frac{1}{2}$ a Part, the Scima 4, the Fillet $\frac{1}{4}$, the Ovolo 1 $\frac{1}{4}$, the Corona 1 $\frac{1}{2}$, the

 Ogee

Ogee 1, and the Fillet $\frac{1}{2}$ a Part.

For the *Projections* the Scima hath 1 $\frac{3}{4}$, the Corona 2 $\frac{1}{2}$, and the Whole 3 $\frac{1}{2}$, as in the Figure.

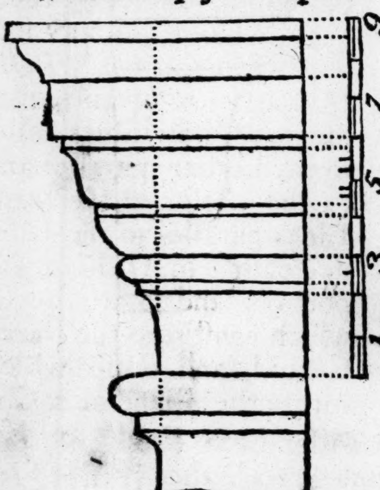
In the *Corinthian* Impost,



the Frize hath 1 $\frac{3}{4}$, the Fillet $\frac{1}{4}$, the Astragal $\frac{1}{2}$ a Part, the Scima 2 $\frac{1}{4}$, the Fillet $\frac{1}{4}$, the Ovolo 1, the Corona 1 $\frac{1}{2}$, the Ogee 1, and the Fillet $\frac{1}{2}$ a Part.

For the *Projections*, the Fillet hath $\frac{1}{4}$, the Astragal $\frac{3}{4}$, the Scima 1 $\frac{3}{4}$, the Corona 2 $\frac{1}{2}$, and the Whole 3$\frac{1}{2}$, as in the Figure.

In the *Composite* Impost,



the Frize hath 2, the Fillet $\frac{1}{4}$, the Astragal $\frac{3}{4}$, the Ovolo 1, the Fillet $\frac{1}{4}$, the Scima 1 $\frac{1}{2}$, the Fillet $\frac{1}{4}$, the Corona 1 $\frac{1}{2}$, the Ogee 1, and the Fillet $\frac{1}{2}$ a Part.

For the *Projections*, the Fillet hath $\frac{1}{4}$, the Astragal $\frac{3}{4}$, the Ovolo 1 $\frac{1}{2}$, the Scima 2 $\frac{1}{4}$, the Corona 2$\frac{1}{2}$, and the Whole, 3$\frac{1}{2}$. as in the Figure.

The *Collerino* of each of the last 4 Orders is 1 of these Parts, and the Fillet $\frac{1}{2}$ a Part more.

For the *Projections*, the Fillet is $\frac{1}{2}$ a Part, and the Whole 1 and $\frac{1}{4}$.

IMPROPER FRACTIONS [in *Arithmetick*] are such as have their Numerators equal to, or greater than their Denominators as $\frac{3}{3}$ $\frac{5}{3}$ &c. which are not properly Fractions, but either whole or mixt Numbers, and are only put into the Form of *Fractions*, in Order to be added, substracted, multiply'd or divided.

INCH is a known Measure, the twelfth Part of a Foot, containing the Space of three Barly Corns in Length.

INCIDENCE *Point* [in *Opticks*] is that Point in which a Ray of Light is suppos'd to fall on a Piece of Glass.

INCOMMENSURABLE *Numbers* [in *Arithmetick*] are such as have no common Divisor, that will divide them both equally, as 3 and 5.

INCOMMENSURABLE *Quantities* [in *Geometry*] are those, which have no aliquot Part, or any common Measure that may measure them, as the Diagonal

Diagonal and the Side of a Square; for altho' that each of these Lines have infinite aliquot Parts, as the half the Third, &c. yet not any Part of the one being ever so small, can possibly measure the other, as is demonstrated by *Euclid.* III. 117. El. 10. but yet is commensurable in Power.

INCOMPOSITE Numbers are the same with those *Euclid* calls Prime Numbers.

There is a Table of Incomposite Numbers in Dr. *Pell's* Edition of *Brancher's Algebra*, which not only gives an orderly Enumeration of all odd Numbers, which are not Composite; but it shews also that none of the Rest are so. This Table being useful, the Reader may have Reference to it.

INDETERMINED PROBLEM is one which is capable of an infinite Number of Answers, as to find 2 Numbers, whose Sum together with their Product shall be equal to a given Number, or to make a Rhomboides such, that the Rectangle under the Sides be equal to a given Square; both of which Problems, will have infinite Solutions.

INDIGO is a dark blue if work'd by it self; but it is usually mix'd with white to remedy this; and then it makes but a very faint blue; this Colour is the Tincture of a Vegetable call'd by that Name, and also *Anil*, and grows in both the West and East *Indies*, the Leaves of which being put into wooden Cisterns fill'd with Water, are often stirr'd violently, till the greatest Part be reduc'd to a Slime or Mucilage, which being separated from the Water, when sunk to the Bottom and dry'd, produces that Substance, which is by us call'd *Indigo.*

Indigo will grind very fine, and lie with a good Body, and is very much us'd in vulgar Painting.

Note, That the longer this Colour is ground, the more beautiful and fair it will look.

INDIVISIBLES [in *Geometry*] are such Elements or Principles as any Body or Figure may ultimately be resolv'd into: And these Elements or Indivisibles are in each peculiar Figure suppos'd to be infinitely small.

1. With Regard to which Notion, a Line may be said to consist of Points, a Surface of Parallel Lines, and a Solid of Parallel and Similar Surfaces: and then because each of these Elements is suppos'd to be indivisible, if in any Figure a Line be drawn thro' the Elements perpendicularly, the Number of Points in that Line, will be the same Number of Elements.

2. Whence we may see, that a *Parallelogram*, *Prism* or *Cylinder* is resolvable into Elements or Indivisibles, all equal to each other, parallel and like to the Base, a *Triangle* into Lines parallel to the Base, but decreasing in Arithmetical proportion, and so are the Circles which constitute the Parabolick Conoid, and those which constitute the Plane of a Circle of the Surface of an Isoscele, Cone.

3. A *Cylinder* may be resolv'd into Cylindrical Curve Surfaces, having all the same Height and continually decreasing inwards.

If a finite Quantity be divided by an infinitely small one, the Quotient will be an infinitely great one: and if a finite Quantity be multiply'd by an infinitely small one, the Product will be an infinitely small one.

But if by an infinitely great One, the Product will be an finite Quantity.

If an infinitely small Quantity be multiply'd or drawn into an infinitely great one, the Product will be a finite one.

INFINITELY INFINITE FRACTIONS, a Term us'd when all the Fractions, whose Numerator is 1. are together equal to an Unite; And hence it is deduc'd, that there are not only *infinite* Progressions, or Progressions *in infinitum*, but also *infinitely* farther than one Kind of Infinity.

That these infinitely infinite Progressions are notwithstanding computable, and to be brought into one Sum; and that not only finite; but into one so small, as to be less than any assignable Number: That of infinite Quantities Some are equal, others unequal: That one infinite Quantity may be equal to 2 or 3 or more Quantities, whether finite or infinite.

INFINITE or INFINITELY great QUANTITY, is that which has no Bounds, Ends or Limits.

INFINITELY SMALL QUANTITY, is that which is so very small, as to be incomparable to any finite Quantity, or which is less than any assignable Quantity.

1. No infinite Quantity can be augmented or lessen'd by adding to or taking from it a finite Quantity: Neither can a finite Quantity be augmented or lessen'd by adding to, or taking from it an infinitely small Quantity.

2. If there be 4 Proportionals, and the First is infinitely greater than the Second, then the Third must be infinitely greater than the Fourth.

INORDINATE PROPORTION is when the Order of Terms is disturb'd; as supposing 3 Magnitudes in one Rank, and 3 other proportional to them in another, and you compare them in a different Order; as suppose there are in one Rank these three Numbers 2, 3, 9; and in another Rank these other three 8, 24, 36; Proportional to the Precedent in a different Order, so that 2 shall be to 3 as 24 to 36, and 3 to 9 as 8 to 24, then casting away the mean Terms in each Rank conclude the first 2 in the first Rank is to the last 9, as 8 the first of the other Rank to the last 36.

INSCRIBED [in *Geometry*] a Figure is said to be inscrib'd in another, when all the Angles of the Figure inscrib'd touch either the Angles, Sides, or Planes of the other Figure.

INSULATED [*Insulatus*] is a Term apply'd to a Column that

that stands alone, or free from any contiguous Wall, *&c.* like an Island in the Sea. The *French* call it *Isolee.*

INTACTÆ are right Lines, to which curves do continually approach and yet never meet with them; these are usually called *Asymptotes.*

INTERCOLUMNIATION [in *Architecture*] is the Space between two Columns, which in the *Dorick* is regulated according to the Distribution of Ornaments in the Frieze; but in the other Orders, according to *Vitruvius*, is of five different Kinds, *viz. Picnostyle, Systyle, Eustyle, Diastyle* and *Aræostyle.* This is by the *Latins* call'd *Intercolumnium.*

M. *Le Clerc* says, that where the Columns of the *Tuscan* Order are without Pedestals, and without Porticoes too, there are three several Spaces or Distances, at which they may be plac'd, *viz.* a large, a mean, and a little Distance.

The first and second shew the greatest and least Space, which can be reasonably interpos'd between the Columns of the Order, when they follow each other one by one; and the third shews how near they may be plac'd, when they are to follow each other 2 by 2.

When those Columns stand 2 by 2, between each Pair the greatest Distance must be made, which is 9 Modules, reckoning from the Axis of the one to that of the other.

When they follow each other 1 by 1, the Interval ought not to exceed 4 Modules, 20 Minutes, from one Axis to the other.

It is not, he says, however to be suppos'd that these Proportions are so precise, as that they may not be varied a few Minutes when Occasion shall require; but this must be observ'd, that the less the Variation is, the better 'twill be.

In the	*Tuscan*	The Intercolumniation must be.	4	Diameters of the Body of the Column below.
	Dorick		3	
	Ionick		2	
	Corinthan		$2\frac{1}{4}$	
	Composite		$1\frac{1}{2}$	

The INTERCOLUMNS of the *Ionick* Order, M. *Le Clerc* says, that the Distances of this Order are adjusted by a certain Number of Denticles, which leave a convenient Space between them; with this Circumstance; that there is always found one in the Middle of each Column.

Thus, he says, when he mentions 35 Denticles between the Axes of the Columns, it is to be understood that there are 24 whole ones, and 2 halves, one at each Extream; the first *Denticles* and the last each being cut into 2 equal Parts by the Continuation of the Axis of the Columns.

Whence it may be observ'd, that in case there be a Necessity for

for augmenting or diminishing the Inter-columns, it must be done by augmenting or diminishing the Number of these *Denticles*, which however, ought never to exceed 1 or 2 *Denticles* at the most.

In the *Roman Order*. As in the *Ionick Order*, the Distances of the Columns are to be adjusted by a certain Number of Denticles; so, he says, in this Order, they must be adjusted by a certain Number of Modillions; with this Restriction, that there be always one exactly in the Middle between each Column.

The Inter-Modillions having been at first regulated by the Distance, that ought to be between the two Columns.

INTERSECTION [in *Mathematicks*] the cutting of one Line or Plane by another; thus we say, that the mutual Intersection of 2 Planes is a right Line.

INTERTIES } [in *Archi-*
INTERDUCES } *tecture*]
are those smaller Pieces which lie Horizontally between the Sommers, or between them and the Sell and Raison.

INTERVAL *Of the Fits of easy Reflection, and of easy Transmission of the Rays of Light.* Is the Space between every Return of the Fit and the next Return. These Intervals Sir *Isaac Newton* shews how to collect, and thence to determine whether the Rays shall be reflected or transmitted at their subsequent incidence on any pellucid Medium.

INVERSION an Action by which any Thing is inverted or turn'd backwards. Problems in Geometry and Arithmetick are often proved by *Inversion* or making a contrary Rule or Demonstration.

JOBENTS, see *Nails*.

JOINT [in *Architecture*] is the Separation between the Stones, which is filled with Mortar, Plaister or Cement.

JOINT [in *Carpentry*, &c.] signifies the several Manners of Assembling of Pieces of Wood together, as a Dovetail-Joint, &c.

JOINT RULE, see *Rule*.

JOGGLE PIECE, see *Crown Post*.

JOISTS [in *Architecture*] are those Pieces of Timber fram'd into the Girders and Summers, on which the Boards of the Floors are laid.

Scantlings of Joists, at full Length (to bear in the Wall)

Being	12 Foot	ought to be in their Squares.	8 Inches and 3 Inches
	11 Foot 6 Inches		7 Inches and 3 Inches
	10 Foot 6 Inches		6 Inches and 3 Inches

And binding or trimming Joists.

Being in Length	7 Foot	Ought to be in their Squares	6 Inches and 5 Inches
	9 Foot		7 Inches and 5 Inches
	11 or 12 Foot		8 Inches and 5 Inches

1. *Their Distance and Position*]. 1. No Joists ought to lie at a greater Distance from each other, than 10 (or at most than 12) Inches.

2. All Joists on the Back of a Chimney, ought to be laid with a Trimmer, at 6 Inches Distance from the Back.

3. No Joists ought to bear at a longer Length than 10 Foot

4. No Joists ought to lie less than 8 Inches into the Brick-Wall.

5. Some Carpenters furr their Joists (as they call it) that is, they lay 2 Rows of Joists one over another; the undermost of which are fram'd Level with the under side of the Girder, and the uppermost (which lie cross the lower ones) lie Level with the upper side of the Girder.

JOINERY, the Art of working in Wood, or of fitting and assembling various Parts or Members together: It is call'd by the *French Menuiserie* q. d. Small Work, by which it is distinguish'd from *Carpentry*, which is conversant in larger and less curious Works.

Joiners Work.

JOINERS measure their Work by the Yard Square; but they take their Dimensions differently from others; for they have a Custom so to do, saying, *they ought to measure where the Plane touches*; and therefore in taking the Height of any Room, about which there is a Cornish, and swelling Pannels and Mouldings; they with a String begin at the Top, and girt over all the Mouldings; which will make the Room to measure much higher than it is; and as for measuring about the Room, they only take it as it is upon the Floor.

Example 1. If a Room of Wainscot being girt downwards over the Mouldings) be 15 Feet 9 Inches high, and 126 Feet 3 Inches in Compass, how many Yards are contain'd in that Room?

Multiply the Compass by the Height, and the Product will be 1988 Feet, 5 Inches, 3 Parts; which being divided by 9, gives 220 Yards, and 8 Feet, the Answer.

Feet	Inches.	
126	3	
15	9	
630		
126		
63 :	1 :	6
31 :	6 :	9
3 :	9 :	0
9) 1988 :	5 :	3

Answer 220 : 8 Fa.

126 : 25
15 : 75

63125
88375
63125
12625

9) 19884375

220 : 8

Example

Example 2. If a Room of Wainſcot be 16 Feet 3 Inches high (being girt over the Mouldings) and the Compaſs of the Room is 137 Feet 6 Inches, how many Yards does it contain.

F.		I.		
137	:	6		
16		3		
830				
137				
34	:	4	:	6
9) 2234	:	4	:	6
248	:	2	:	0

Multiply 137 Feet 6 Inches, by 16 Feet 3 Inches, and the Product will be 2234 Feet, 4 Inches 6 Parts, which being divided by 9, the Quotient will be 248 Yards, and 2 Feet.

137.5	
162.5	
6875	
2750	
8250	
1375	
9) 2234.375	
248	2

Facit 248 Yards, 2 Feet.

2. Joiners Work, or Wainſcotting.

By Scale and Compaſs.

For the *Firſt Example*, Extend the Compaſſes from 9 to 126,25 and that Extent will reach from 15, 75, to 220, 9 Yards.

For the *Second Example*, Extend the Compaſſes from 9 to 137,5 and that Extent will reach from 16,25 to 248 Yards and about a Quarter.

In Joiner's Work it is to be obſerv'd, and that in meaſuring of Doors and Window-Shutters, and all ſuch Work as is wrought on both Sides, they are paid for Work and half Work; ſo that in meaſuring all ſuch Work, the Content is firſt to be Found, as before, and half that Content muſt be added to it; and that Sum ſo added, will be the Content at Work and Half.

Example. If the Window-Shutters about the Room be 69 Feet 9 Inches broad, and 6 Feet 3 Inches high, how many Yards do they contain at Work and Half.

Multiply 69 Feet 9 Inches by 6 Feet 3 Inches, and the Product will be 435 Feet 11 Inches 3 Parts; the Half of which is 217 Feet 11 Inches 7 Parts; which being added together, the Sum will be 653 Feet 10 Inches and 10 Parts; which being divided by 9, the Quotient will be 72 Yards 5 Feet, the Content at Work and Half.

F.	I.	
69	9	
6	3	
418	6	
17	3	
435	11	3
217	11	7
9)653	10	10
72	5	

Facit 72 Yards, 5 Feet

69 . 75
6 . 25
34875
13250
41850
435 . 9375
217 . 9687
635 . 9062

By Scale and Compass.

Extend the Compasses from 9 to 69 . 75, and that Extent will reach from 6 . 25 to 48 . 4 Yards; the Half of which is 24 . 2, which being added together make 72 . 6 Yards, the Content at Work and Half.

Note, That Deductions are to be made for all Window-Lights; but Window-Boards Sopheta Boards and Cheeks, must be measured by themselves.

IONICK ORDER [in *Architecture*] is the third of the five Orders, and is a Kind of mean between the strong and delicate Orders. Its Capital is adorn'd with Volutes, and its Cornish with Denticles.

The Proportions of this Pillar as they are taken from the famous one in the Temple of *Fortuna Virilis* at *Rome*, now the Church of St. *Mary* the *Ægyptian* are these.

1. The *Entire Order*, from the Superficies of the Area to the Cornice are 22 Modules, or 11 Diameters.

2. The *Column* with its Base contains 18 Modules.

3. The Entablature (i. e. the *Architrave*, *Frieze* and *Cornice*) contains 4 Modules.

4. The *Volute* of the Capital is of an Oval Form.

5. The Columns in this Order are often hollowed and furrowed with 24 Gutters, or Channels, call'd Flutes, these Flutings are not always Concave from the top of the Shaft to the bottom; but for that third of it next the Base, are fill'd up with a Kind of Rods or Canes, by the *French* call'd *Batons*, and in the other 2 thirds are left hollow, or striated in imitation of the Folds or Plaits of a Garment.

The first Idea of this Order was given by the People of *Jonia*, who according to *Vitruvius* form'd it on the Model of a young Woman, dress'd in her Hair, and of an elegant Shape; whereas the *Dorick* had been form'd on the Model of a strong, robust Man.

The *Jonick* Order is distinguish'd from the *Composite* in that it has none of the *Acanthus* Leaves in its Capital, and from

from the *Tuscan* and *Dorick* too, by the Channels or Fluting in its Shaft.

When this Order was first invented, its Height was but 16 Modules; but the Ancients to render it still more beautiful than the *Dorick*, augmented its Height by adding a Base to it, which was unknown to the *Dorick*.

M. *Le Clerc* makes its Entablement 4 Modules & 10 Minutes, and its Pedestal 6 intire Modules; so that the whole Order makes 28 Modules 10 Minutes.

It is said, that the Temple of *Diana* at *Ephesus*, the most celebrated Edifice of all Antiquity, was of this Order.

This Order is at present us'd properly in Churches and religious Houses, Courts of Justice, and other Places of Tranquillity and Devotion.

This Order has one Advantage above any of the Rest which consists in this, that the fore and hind parts of its Capital are different from its Sides; but this is attended with an Inconvenience, when the Ordonnance is to turn from the Front of the Building to the Side: To obviate which the Capital may be made Angular, as is done in the Temple of *Fortuna Virilis*.

Scamozzi and some other modern Architects have introduc'd the upper Part of the *Composite* Capital in Lieu of the *Ionick*; imitating that of the *Temple of Concord*, the 4 Sides of which are alike, in Order to render it more beautiful, the Volute may be made a little more Oval and inclining.

The Proportions of the *Ionic* Order by equal Parts, are given by some late Authors as follows.

The whole Height is divided into 13 Diameters and a half; the Pedestal having two and two thirds, the Column nine, and the Entablature one and four fifths.

The Height of the *Pedestal* being 2 Diameters and $\frac{2}{3}$, is divided into 4, giving 1 to the Base, whose Plinth is $\frac{2}{3}$ thereof, the other Part is divided into 8, giving 1 to the Fillet, 4 to the Cymase, 1 to the Fillet, and 2 to the Hollow, the breadth of the Die, is 1 Diameter and $\frac{1}{3}$, and the *Projection* of the Base is equal to its Height, the upper Fillet hath 3 of these Parts, and the lower Fillet 7; the Height of the Cornice is half the Base, being $\frac{1}{8}$ of the whole Height, and is divided into 10, giving 2 to the Hollow, 1 to the Fillet, 4 to the Corona, 2 to the Ogee, and 1 to the Fillet; the *Projection* of the Hollow hath 3 of these Parts, the Corona 6, and the whole 8.

The *Base* of the Column, the Height is $\frac{1}{2}$ a Diameter, and is divided into 6, giving 1 and $\frac{3}{4}$ to the Plinth, 1 and $\frac{1}{4}$ to the lower Torus, $\frac{1}{4}$ to the Fillet, 1 to the Scotia, $\frac{1}{4}$ to the Fillet, 1 to the upper Torus, and $\frac{1}{2}$ a Part to the Bead [b] at Top; the Fillet above the Bead is equal to the others, and is Part of the Column; the *Projection* is 2 of these Parts, $\frac{1}{3}$ thereof is for the

the upper Fillet, and $\frac{2}{3}$ for the upper Torus; the Scotia is form'd by the Rule ſhewn in the *Doric*.

The DIMINISHING of this Column, is $\frac{1}{8}$ of the Diameter.

For the *Capital*, divide the Diameter into 9 Parts, and 4 and $\frac{3}{4}$ is the whole Height, giving 1 and $\frac{1}{4}$ from the bottom of the Volutes [c] to the Fillet, $\frac{1}{4}$ to the Fillet, $\frac{1}{2}$ a Part to the Aſtragal [d], 1 to the Ovolo [e], $\frac{3}{4}$ to the Volute, $\frac{1}{4}$ to the Rim [f], $\frac{1}{2}$ a Part to the Ogee, and $\frac{1}{4}$ to the Fillet.

The *Projection* of the Ogee is 1 of theſe Parts. For forming the *Volute* deſcribe a Circle in the Centre of the Aſtragal, equal to the Height thereof, and make the Diviſions into 3, as is ſhewn in the Figure A, then placing one foot of the Compaſſes in the Centre marked 1, extend the other to the top of the Rim, and deſcribe a Quarter of a Circle, and removing the foot into the Centre 2, deſcribe another Quarter, and ſo proceeding to all the reſt as they are marked. For the *Diminiſhing* of the *Rim*, each Diſtance between the Centres is divided into five, and the neareſt Diviſion within the old ones, is the new Centre for the ſame.

The Height of the *Entablature* being 1 Diameter and $\frac{4}{5}$ is divided into 6, 2 are for the Architrave 1, and $\frac{1}{2}$ for the Frize, and 2 $\frac{1}{2}$ for the Cornice.

The *Architrave* is divided into 9, giving 1 and $\frac{3}{4}$ to the firſt Face, 2 and $\frac{1}{2}$ to the ſecond, and 3 to the third, 1 and $\frac{1}{4}$ to the Ogee, and $\frac{1}{2}$ a Part to the Fillet: The *Projection* of the 2d and 3d Faces have a $\frac{1}{4}$ of a Part each, and the Whole 2 of theſe Parts.

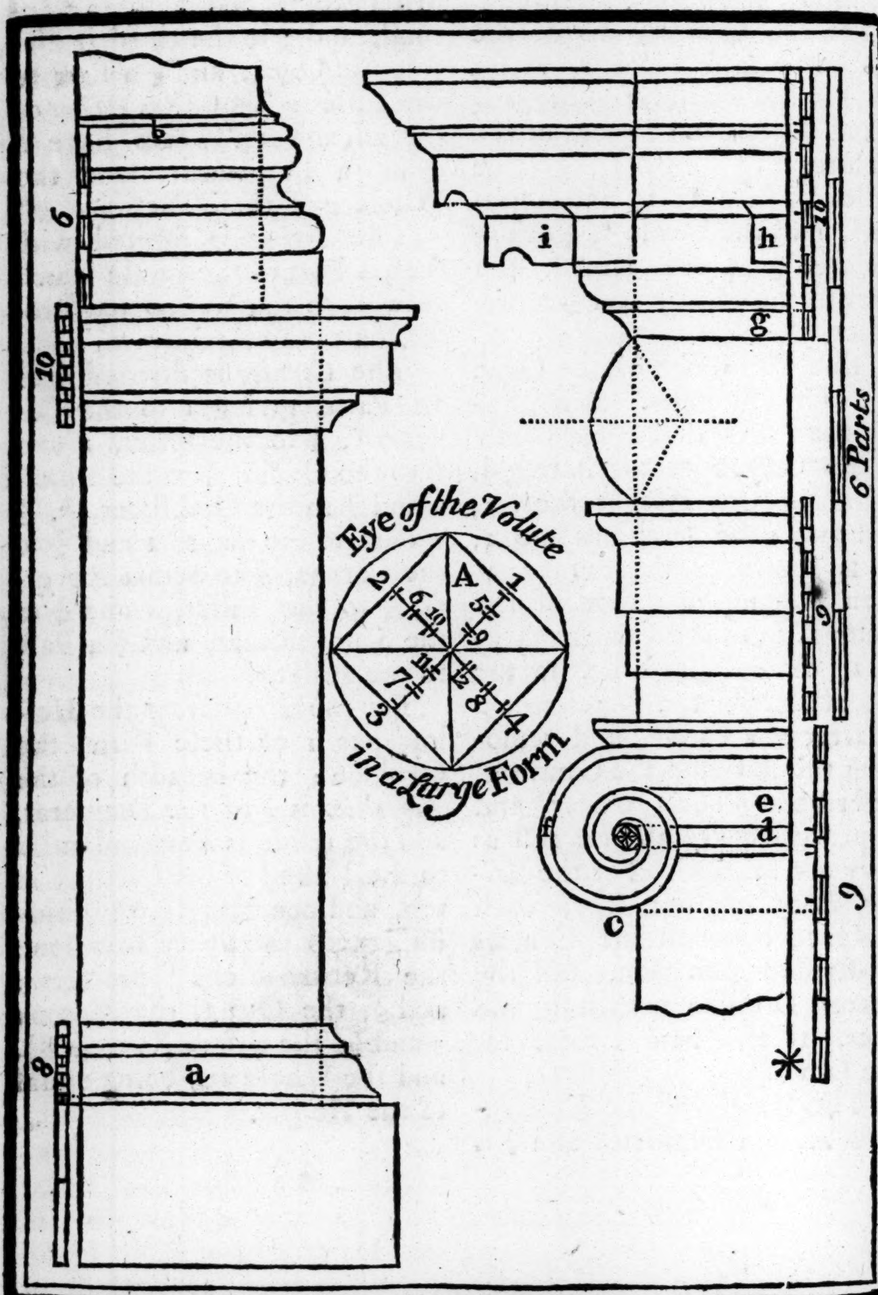
The *Frize* is formed with ſuch a Part of the Circle which anſwers to the Naked and Projection of the Architrave.

The *Cornice* is divided into 10 Parts, giving 1 to the Cavetto [g], $\frac{1}{4}$ to the Fillet, 1 and $\frac{1}{4}$ to the Ovolo, $\frac{1}{4}$ to the Fillet, 2 and $\frac{3}{4}$ to the Modillions, [h], $\frac{1}{2}$ 1 Part to the Caps, 1 and $\frac{3}{4}$ to the Corona, $\frac{3}{4}$ to Scima Reverſa, $\frac{1}{4}$ to the Fillet, 1 and $\frac{3}{4}$ to the Scima Recta, and $\frac{1}{2}$ a Part to the Fillet.

For the *Projections* the Hollow has 1 of theſe Parts, the Ovolo 2; the breadth of the *Modillion* is $\frac{1}{6}$ of the Diameter, and the inſide is Perpendicular to the Naked of the Column at top, and one being in the middle, gives the Space between; 3 the Return'd one [i] projects 5 and $\frac{1}{2}$, the Cap 6, the Corona 7 and $\frac{1}{2}$, the Scima Reverſa $8\frac{1}{4}$, and the Whole 10, being equal to the Height.

The

The Proportions of the Ionic *Order, by equal Parts.*



IRON is a hard fusible and malleable Metal, of vast Use in Building, and many other Affairs in Life.

It consists of an Earth, Salt, and Sulphur; but all impure, ill mix'd and digested, which renders it very liable to Rust.

It is the hardest, driest, and most difficult to be melted of all Metals.

It may be softened, by heating it often in the Fire, hammering it, and letting it cool of it self; and is hardned by extinguishing it in Water.

It may be rendered white by cooling it in Sal Armoniac and quick Lime.

The strongest Temper of *Iron*, is said to be that, which it takes in the Juice of strain'd Worms.

Iron has a great Conformity with Copper, so that they are not easily separated when soldred together.

Iron has also a great Conformity with the Loadstone. *Rohault* says, that it is it self an imperfect Loadstone, and that if it be a long Time exposed in a certain situation, it becomes a real Loadstone, and mentions the Iron in the Steeple of *Notre-Dame* at *Chartres* as an Instance.

[The *Kinds of Iron.*] There are several Kinds of Iron that have Properties very different from one another; as,

1. *English*, Which is coarse, hard and brittle, fit for Fire Bars, and other such coarse Uses.

2. *Swedish Iron*, which of all others, is the best, us'd in *England*. It is a fine, tough sort of Iron, which will best endure the Hammer, is softest to File, and in all Respects the best to Work upon; and therefore most coveted by Workmen.

3. *Spanish Iron*, which would be as good as the *Swedish*, were it not subject to *Red-Sear*, (as Workmen phrase it) that is, to crack between hot and cold; therefore when it falls under your Hands, you must tend it more diligently at the Forge. But tho' it be a good, tough, soft Iron, yet Workmen refuse it for many Uses, because 'tis so ill and unevenly wrought in the Bars, that it costs them a great Deal of Labour to smooth it; but it is good for all great Works, which require Welding, as the Bodies of Anvils, Sledges, large Bell-Clappers, large Pestles for Mortars, and all thick strong Bars, &c. But it is particularly chosen by Anchor Smiths, because it abides the Heat better than other Iron, and when 'tis well wrought, is the toughest.

4. *German Iron*, which goes by the Name of *Dort Square*, because it is brought hither from thence, and is wrought into Bars of 3 Quarters of an Inch Square; this is a bad, coarse Iron, and only fit for ordinary Uses, as Window-Bars, Brewers Bars, Fire Bars, &c.

5. There is another Sort of Iron for making of Wire, which is the softest and toughest of all Iron. This Sort is not peculiar to any Country; but is indifferently made, wherever Iron is

made, tho' of the worst Sort; for 'tis the first Sort that runs from the Mine Stone, and is reserv'd purely for the making of Wire.

To know good Iron.] Generally speaking, the best Iron is the softest and toughest, and that which when it breaks is of an even greyish Colour, without any of those glittering Specks, or any Flaws or Divisions, like to those seen in broken Antimony.

Therefore when you chuse it, chuse such as bows oftenest before it breaks, which is an Argument of toughness, and see that it breaks sound within, of a greyish Colour, &c. And that there be no Flaws or Divisions in it; for these are Arguments that 'tis sound, and has been well wrought at the Mill.

To give Iron a true blue Colour.] Rub off the black Scurf with a Grind-Stone or Whet-Stone, rubbing hard upon the Work: then heat it in the Fire, and as it grows hot, it will change the Colour by Degrees, becoming first of a light Gold Colour, then of a darker Gold Colour, and then of a beautiful Blue. But sometimes Work-men Grind Indigo and Sallad-Oil together, and rub that Mixture upon it with a Woollen Rag, while it is heating, and let it cool of it self.

Of *Twisting Iron.*] Square and flat Bars of Iron are sometimes (by Smiths) twisted for Ornament, which is very easily done, and the Manner of doing it is as follows: After the Bar is square or flat forged (and if the Curiosity of the Work require it, truly fil'd) they give it a *Flame Heat*; or if the Work be small, but a *Blood red Heat*, and then it is easily twisted about as much or as little as they please, with the Tongues, Vice, or the like.

The Price of Iron when wrought.] Iron being wrought by the Smith into Dogs, Bars, Staples, large Hooks, Hinges, Grates, &c. the usual Price is $3\frac{1}{2}$*d.* or 4*d. per* Pound: But for small and neat Hooks, Hinges, Bolts, Staples, &c. various, as from 4*d.* to 8*d. per* Pound.

The several Heats which the Smiths give their Iron in working are,

1. A *Sparkling* or *Welding Heat*, which is used when they double up their Iron, or weld 2 Pieces of Iron together End to End.

2. A *Flame* or *White Heat*, which is us'd when the Iron has not its Form or Size, but must be forg'd into both.

3. *Blood Red Heat*, which is used when the Iron has already its Form and Size, but wants a little Hammering to smooth and fit it for the File.

If the Iron be made too Hot, it will red-sear, *i. e.* break or crackle under the Hammer while it is working between hot and cold.

IRON-MOULDS, are certain Yellow Lumps of Earth or Stone, found in Chalk-Pits about the *Chiltern* in *Oxfordshire*, which are really a Kind of indigested Iron Ore.

IRON

IRON-ORES, IRON-WORKS. Of these we have a great Number in most Parts of *England*; but those in the *Forest of Dean* in *Glocestershire*, are in the most Repute.

The Ore is there found in great Abundance, differing much in Colour, Weight, and Goodness.

The best, which is called *Brush Ore*, is of a Blueish Colour, very ponderous, and full of little shining Specks, like Grains of Silver: This affords the greatest Quantity of Iron; but being melted alone, produces a Metal very short and brittle, and therefore not so fit for common Use.

In Order to remedy this Inconvenience, the Workmen use another Sort of Material call'd *Cinders*, which is no other than the Refuse of the *Ore*, after the Metal has been extracted; and which being mingled with the other in due Quantity, gives it an excellent Temper of Toughness, which makes this *Iron* to be preferred before any other brought from Foreign Parts.

After the Ore is Provided, the first Work is to Calcine it, which is done in Kilns, much after the Fashion of our Common Lime Kilns; which are filled up to the Top with Coal and *Ore*, *Stratum super Stratum*, i. e. Layer upon Layer; and then setting Fire to the Bottom, they let it burn 'till the Coal is wasted, and then renew the Kiln with fresh Ore and Coals, in the same Manner as before.

This is perform'd without fusing the Metal, and serves to consume the more drossy Part of the *Ore*, and to make it malleable, supplying the beating and washing that are us'd in other Metals.

From thence they carry it to the Furnaces, which are built either of Brick or Stone, about 24 Foot Square on the outside, and near 30 Foot in Height within: not above 8 or 10 Foot over where it is the widest, which is about the middle; the Top and Bottom having a narrow Compass, much like the Shape of an Egg.

Behind the Furnace are fix'd 2 Pair of Bellows, the Noses of which meet at a little Hole near the Bottom; these are compress'd together by certain Buttons, plac'd on the Axis of a very large Wheel, which is turn'd about by Water, in the Manner of an overshot Mill.

As soon as these Buttons are slid off, the Bellows are rais'd again by the Counterpoise of Weights, whereby they are made to play alternately, the one giving its Blast, the time the other is rising.

At first, these Furnaces are fill'd with *Ore* and Cinder intermix'd with Fuel, which in these Works is always of Charcoal, laying them hollow at the Bottom, that they may take Fire more easily; but after they are once kindled, the Materials run together into a hard Cake or Lump, which is sustain'd by the Fashion of the Furnace; and through this the Metal, as it were, meets, trickles

down into the Receivers ſet at the Bottom, where there is a Paſſage open, by which the Men take away the Scum and Droſs, and let out the Metal, as they ſee Occaſion.

Before the Mouth of the Furnace lies a great Bed of Sand, where they make Furrows of the Shape into which they would have the *Iron* caſt.

As ſoon as the Receivers are full, they let in the Metal, which is rendred ſo very fluid by the Violence of the Fire, that it not only runs to a conſiderable Diſtance, but ſtands afterwards boiling for a good while.

When the Furnaces are once ſet to work, they are kept conſtantly employ'd for many Months together, the Fire not being ſuffer'd to ſlacken Day nor Night, but is kept ſtill ſupply'd with Fuel and other Materials poured on at Top as the other waſtes. The Coal us'd in this Work is altogether Charcoal, for Sea Coal will not do.

The Workmen bring their Sows and Pigs of Iron from theſe Furnaces to the Forges, where they are wrought into Bars.

IRRATIONAL Numbers are the ſame as *Surd Numbers*.

IRREGULAR BODIES, are ſuch Solids as are not terminated by equal and regular Surfaces.

IRREGULAR COLUMN [in *Architecture*] is one which does not only deviate from the Proportions of any of the 5 Orders; but whoſe Ornaments, whether in the Shaft or Capital, are abſurd and ill choſen.

ISAGON [in *Geometry*] is ſometimes us'd for a Figure, conſiſting of equal Angles.

ISLES [in *Architecture*] are the Sides or Wings of a Building.

ISOCHRONE *Vibrations* of a Pendulum, are ſuch as are made in the ſame Space of Time, as all the Vibrations or Springs of the ſame Pendulum are; whether the Ark it deſcribes be longer or ſhorter; for when it deſcribes a ſhorter Ark, it moves ſo much the ſlower, and when a long one, proportionably faſter.

ISOCHRONAL LINE, is that in which a heavy Body is ſuppos'd to deſcend without any Acceleration.

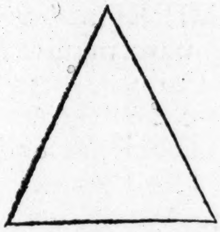
ISOPERIMETRICAL Figures [in *Geometry*] are ſuch as have equal Perimeters or Circumferences.

1. Of *Iſoperimetrical regular Figures*, that is the greateſt that contains the greateſt Number of Sides, or moſt Angles, and conſequently a Circle is the greateſt of all Figures that have the ſame Ambit as it has.

2. Of 2 Iſoperimetrical Triangles, having the ſame Baſe, whereof 2 Sides of one are equal, and the other unequal, that is the greater, whoſe Sides are equal.

3. Of Iſoperimetrical Figures whoſe Sides are equal in Number, that is the greateſt which is equilateral and equiangular.

ISOSCELES TRIANGLE is a Triangle that hath 2 Sides, or Legs equal to one another, and the third Side or Baſe unequal; as in the Figure.



JUFFERS [with *Carpenters*] a Term us'd for Stuff, about 4 or 5 Inches Square, and of several Lengths.

K.

KERF is the sawn away Slit in a Piece of Timber or Board; or the Way made by the Saw, is call'd a Kerf.

KEY-STONE, See *Arch*.

KEYS for Doors are of various Prices, according to their Size and Workmanship, Master Keys *per* piece; 2 or 3 *s*.

KEYS [in *Masonry*] that have a Projecture, and are made in Manner of Consoles, and plac'd in the middle of Arches or Portico's, are particularly design'd to sustain the Weight and Pressure of the Entablature, where it happens to be very great between the Columns; for this Reason they ought to be made in such Manner, as that they may prove a real Support, and not stand for mere Ornaments, as they frequently do. Without this Precaution, M. *Le Clerc* says, he thinks they had better be intirely omitted.

KING-PIECE, See *Crown-Post*.

KNEE, a Piece of Timber cut crooked with an Angle, is call'd a *Knee-Piece* or *Knee-Rafter*.

L.

[illegible]ABEL, is a long, thin brass Ruler, with a small Sight [illegible] one End, and a Center Hole [illegible] the other; commonly us'd [illegible] a tangent Line to the E[illegible]e of a Circumferentor for ta[illegible]g Altitudes, &c.

[illegible]ABORATORY, a Place where Chymists Furnaces are built, their Vessels kept, and their Operations perform'd.

LABYRINTH, a large intricate Edifice, cut out into various Isles, Meanders, running into one another, so as to render it difficult to get out of it.

There is mention made of four celebrated Labyrinths of Antiquity; that of *Crete* is the most famous, built by *Dædalus*, out of which *Theseus* is said to have made his Escape by Means of *Ariadne*'s Crew.

2. That of *Egypt*, which according to *Pliny* was the oldest of all, and was standing in his Time, having stood 3600 Years, which, *Herodotus* says, was the Work of several Kings, but *Pliny* ascribes it to King *Petesucus* or *Titheos*. It stood on the Banks of the Lake *Myris*, and consisted of 12 Palaces and 1500 Apartments; *Mela* says 3000 Houses.

3. That of *Lemnos*, which was supported by Columns of wonderful Beauty, of which there were some Remains in *Pliny*'s Time.

4. That of *Italy*, built by *Porsenna* King of *Hetruria* for his Tomb.

LACUNAR [in *Architecture*] an arched Roof or Ceiling, more eſpecially the Planking or Flooring above the Portico's and Piazza's.

LAKE, eſpecially the richeſt Sorts, is the beſt of all dark Reds, being a moſt pure crimſon; 'tis a Colour that will grind very fine, and lies with a good Body; but there muſt be much Pains taken in grinding it; for if it be not well and thoroughly ground, its Colour will want much of its Glory; and beſides this, 'twill work with ſome Difficulty; being apt to cling together like a Jelly, after 'tis laid on; juſt as warm Water does upon a greaſy Trencher, when it is waſh'd in it; to prevent which, it muſt be well ground, and tempered as thin, as it can well be work'd.

There are ſeveral Sorts of *Lake* ſold at the Colour Shops, very different, ſome being of a more dead and pale Colour.

It is made of the Tincture of a Vegetable, which ſtains red; but of what, or how done, I have not yet perfectly learn'd: the beſt Sorts of it come from *Venice* and *Florence*.

LANTHORN [in *Architecture*] a Sort of little Dome rais'd over the Roof of a Building to give Light, and to ſerve for a *Corona*, or to finiſh the Building; the Term is alſo us'd for a ſquare Cage of Carpentry, with Glaſs in it, placed over the Ridge of a Corridor or a Gallery, between 2 Rows of Shops, to illumine them, as that in the *Royal Exchange*, *London*.

LARMIER [in *Architecture*] A flat, Square, maſſive Member of the Cornice, between the *Cymatium*, and the *Ovolo*, and jets out fartheſt, being ſo call'd from its Uſe, which is to diſperſe the Water, and cauſe it to fall at a Diſtance from the Wall, drop by drop, or as it were, by Tears, *Larme* in *French* ſignifying a Tear; the *Larmier* is alſo call'd *Corona*.

LATCHES *for Doors* are of various Kinds and Prices; common Iron Latches *per* piece, 6*d.* larger, 8*d.* and 10*d.* Long varniſh'd Latches, at about 10*d.* *per* piece, Rim'd Latches with a ſliding Bolt, 2*s.* *per* piece. Spring Latches, 1 or 1*s.* and 6*d* per piece.

LATHS [for Building] long thin and narrow ſlips of Wood us'd in Tiling or Walling; theſe are diſtinguiſh'd into 3 Kinds according to the different Wood they are made of, *viz.* Heart of Oak, Sap-Laths, and Deal Laths; the 2 laſt Sorts are us'd for Ceilings and Partitioning and the firſt for Tiling only.

Again, Laths are diſtinguiſh'd into 3 Kinds more, in Reſpect to their Lengths, *viz.* into 5 foot, 4 foot, and 3 foot Laths; tho' the Statute allow but of 2 Lengths, *viz.* thoſe of 5 foot and of 3 foot, each of which are to be an Inch and half in breadth, and half an Inch in thickneſs.

All theſe Sorts of Laths are neceſſary, (eſpecially in repairing of old Buildings) becauſe all Rafters are not ſpac'd alike nor yet the Proportion ſtrictly obſerv'd in every one and the ſame Roof.

Bund

Bundle of Laths.] A Bundle of Laths is so many as are bound up together, and is generally call'd a hundred of Laths; tho' of the 3 foot Laths there goes 7 Score or 140 to the hundred or Bundle, and of the 4 foot Laths, 6 Score, but of 5 foot Laths, there goes but just 5 Score to the hundred or Bundle.

The Size of Laths.] The Statute allows but of 2 Sorts of Laths, one of 5 foot, and the other of 4 foot in Length; of either Sort each Lath ought to be in Breadth an Inch and half, and in thickness, half an Inch; but they are commonly less, and are seldom exact, either in their Tales or Measures.

Of Cleaving Laths.] Lath-cleavers having cut their Timber into Lengths, they cleave each piece (with Wedges) into 8, 12 or 16 pieces (according to the largeness of their Timber) which they call *Bolts*; (with their Dowl-Ax) by the *Felt Grain* [which is that Grain which is seen to run round in Rings at the End of a Tree] into Sizes for the Breadth of their Laths, and this Work they call *Felting*.

Then lastly (with their Chit) they cleave their Laths into their thicknesses, by the *Quarter Grain*, which is that Grain which is seen to run in strait Lines towards the Pith.

Some say a Foot of Timber will make a Bundle of a hundred Laths; but this is not true, unless the Laths be made very slight: It has been found by many Experiments, that 40 Foot of Oaken round Timber will not make above 30 hundred, of which Number above 1 third part, *viz.* above 10 hundred will be Sap-Laths.

The Price of Laths.] The common price for cleaving of Laths, is 5*d* or 6*d per* Bundle, tho' some have said, they have had them made in *Sussex* for $4\frac{1}{2}$ *d* the Bundle.

The Price of Laths must of Necessity be various, there being so great a Disparity in them; not only as to their Goodness, but likewise as to their Plenty and Scarcity. But the Prices are generally between 1*s.* and 2*s.* 6*d.* a Bundle: And the common Rate for *Heart Laths* is about 20*d.* and *Sap Laths* $\frac{2}{3}$ of their Price.

Laths are sometimes sold for 4*l.* 10*s.* the Carriage of 60 Bundles, 40 of which have been *Heart Laths*, and 20 *Sap Laths*, at which Rate (reckoning *Sap-Laths* to be $\frac{2}{3}$ of the Price of *Heart Laths*) the *Heart Laths* were sold for 20 $\frac{1}{4}$ *per* Bundle, and the *Sap Laths* at $13\frac{1}{2}$ *d.*

The Nails allow'd to a Bundle of Laths.] The common allowance is 5 hundred (at 6 Score to the hundred, which is 600) Nails to a Bundle of Laths.

How many Laths to a Square.] Workmen commonly allow a Bundle of Laths to a Square of Tiling, which (if the Distances of the Rafters fit the Lengths of the Laths without any waste) is a sufficient Allowance; for then about 90, five foot, and 112, four foot Laths will compleat a Square of Tiling. Counter Laths, and all at

at 7 Inches Gage, and at 8 Inches Gage, a Square, will not require so many.

LATHING. The Price of Lathing, Plaistering, rendring and washing with Size, is about 10*d.* 12*d.* or 14*d.* the Yard, for Materials and Work.

LATION, is the Translation or Motion of a Body from one Place to another in a right Line.

LATUS RECTUM [in *Conicks*] the same as Parameter.

LAZARETTO } a publick
LAZAR-HOUSE } Building in Form of an Hospital for the Reception of poor sick Persons. It is usually a large Building at a Distance from any City, whose Apartments stand at a Distance from each other. In some Countries they are appointed for Persons who come from Places suspected of the Plague to Quarantain in; and where Ships are unladen and their Equipage is laid up for 40 Days, more or less, according to the Time and Place of Departure.

LEAD is a coarse, heavy, and impure Metal, of all others the softest and most fusible, when refin'd; those who have analys'd it, find it contains a little Mercury, some Sulphur, and a great Deal of Bituminous Earth.

Lead is found in various Countries, but most plentifully in *England*. It is likewise found in several Kinds of Soils and Stones, some of which contain besides Gold, some Silver and others Tin. &c.

It is melted in a Furnace provided for that Purpose, with a strong Coal Fire upon it. As it melts, it runs through a Canal on one Side of it, leaving the Earth, Stone and Scoria with the Ashes of the Coals.

It is purified by Skimming it before it is cold, and by throwing Suet and other fat Bodies into it: Some able Naturalists have observ'd, that Lead increases in Weight, either in the open Air, or under Ground.

Mr. *Boyle* observes this particularly of the Lead of Churches, which, he says, grows frequently both in Bulk and Weight, so as to become too ponderous for the Timber that before sustain'd it; which some account for from the Impurity, Hetero-Geneity, and loose Texture of its Parts, by means of which the Particles of the Air getting Admission within its Pores, are attracted and easily assimilated to it.

But others who rely wholly on Experience, absolutely deny the Effect, as also that it is reproduc'd in Mines before exhausted, by letting them lie long open to the Air, which others assert.

Lead is found of a lighter or deeper Colour, accordingly as it is more or less purified, tho' some make a Difference in the Colour of the Ore, always esteeming that most which is the whitest.

Lead is much us'd in Building, especially for Coverings, Gutters, Pipes and Glazing.

Lead is either cast into Sheets in a Mold, or mill'd, which last is found by much the

he leaſt ſerviceable, not only
n Account of its thinneſs; but
lſo becauſe 'tis ſo exceedingly
tretch'd in milling, that when
t comes to lie in the hot Sun,
t ſhrinks and cracks, and of
onſequence will not keep out
he Water.

The *Lead* us'd by *Glaſiers* is
irſt caſt into ſlender Rods, 12
r 14 Inches long, call'd *Canes*,
which being afterwards drawn
hro' their Vice, comes to have
Groove on either Side for the
anes of Glaſs, and this they
all *turn'd Lead*.

There are 3 Sorts of *Lead*,
white, black, and aſh-colour'd,
he white is more perfect and
recious than the black, and
he Aſh colour between both.

Of caſting Sheet Lead.] To
o this, there is a Mould provided, which is ſomething longer
han the Sheets are intended to
e, that the End where the
Metal runs off from the Mould
may be cut off, becauſe 'tis
commonly thin and uneven, or
agged at the End.

This Mould which is the
exact Breadth that the Sheets
re to be, muſt ſtand very even
r level in Breadth, and ſomething falling from the End
where the Metal is pour'd in,
viz. about an Inch or Inch and
half in the Length of 16 or 17
Feet.

This Mould uſually conſiſts
of ſeveral Treſſels, upon which
Boards are laid and nail'd down
aſt, and upon theſe at a due
Diſtance (according to the intended Breadth of the Sheets)
he Sharps are fix'd.

Theſe Sharps are 2 Pieces of well ſeaſon'd Timber, of about 4 Inches Square, and 16, 17 or 18 Foot in Length, according to the Size of the Sheets.

But ſome having found an inconveniency in this Method of fixing down the Shafts, they only fix one of the Sharps firmly, nailing the other on but ſlightly, and then they fix ſeveral Pieces firmly to the Boards, without the ſlightly fix'd Sharps, betwixt which and the Sharp they drive Wedges, to make the Sharps come nearer together, as they ſee Occaſion; they having found by Experience, that the moiſtened Sand (when it has lain a while on the Boards) makes the Boards ſwell ſo much, that notwithſtanding the Nails, the Sharps will be too far aſunder.

At the upper End of the Mould ſtands the *Pan*, which is a Concave Triangular *Priſm*, compos'd of 2 Planks nail'd together at right Angles to each other, and 2 triangular Pieces fitted in betwixt them at the Ends.

The Length of this *Pan* is the whole Breadth of the Mould in which the Sheets are caſt, and the Breadth of the Planks of which 'tis compos'd, may be about 12 or 14 Inches, or more, according to the Quantity of Lead they have Occaſion to put into it to make a Sheet of, and the thickneſs of the Planks an Inch and a half.

This *Pan* ſtands with its Bottom (which is a ſharp Edge) on a Form at the End of the Mould, leaning with one Side againſt

againſt it, and on the oppoſite Side is a Handle to lift it up by, to pour out the melted Lead; and on that Side of the Pan next the Mould, are 2 Iron Hooks to take hold of the Mould, and prevent the Pan from ſlipping, when they pour the melted Lead out of it into the Mould.

This *Pan* is lin'd on the Inſide with moiſten'd Sand, to prevent it from being fired by the hot Metal.

The Mould is alſo fill'd up (from the upper End towards the lower End about $\frac{2}{3}$ parts of the Way with Sand ſifted and moiſtened, after which a Man gets upon it, and treads it all over, with his Shoes on, to make it ſettle cloſe to the Mould.

This being done, they begin to ſtrike it Level with the *Strike*, which is a Piece of Board about 5 Inches broad, in the middle of which and towards the upper Edge is a wooden Pin (about 5 or 6 Inches long, and 1 or 1 $\frac{1}{4}$ Diameter) to hold it by when they uſe it.

The Length of this Strike is ſomething more than the Breadth of the Mould on the Inſide, and at each End is cut a Notch on the under Edge, about 2 Inches deep; ſo that when the Strike is us'd, it rides upon the Sharps with thoſe Notches, and the lower Edge of the *Strike* rides about 2 Inches below the upper Side of the Sharps.

Then in levelling the Sand with the *Strike*, they begin towards the lower End of th Part of the Mould that w fill'd, and taking the Hand of the Strike in their rig Hand, and laying the le Hand upon one End of it, the draw the Sand back into th Part of the Mould that w empty.

Then they begin again a li tle nearer to the upper En and draw the Sand back (before) but not ſo far as t empty Part of the Mould; that when it is thus levell the whole Length of the Moul there are as many Places whi ſeem to be unlevell'd as the are levell'd, by Reaſon of t Sand which is a little dra back.

The next Operation is draw all the looſe and Ho Sand (raiſ'd in the laſt leve ing) into the empty Part of t Mould; to do which they b gin at the upper End of t Mould, and ſtill as the Sand drawn back, the levell'd P muſt be examin'd to ſee t there be no Cavities in which if there be, a little Sa muſt be put into them, a that muſt be ſettled cloſe a faſt in the Cavities, by lifti up one End of the Strike (l ting the other reſt upon t other Sharp) and rapping u the looſe Sand which was into the Cavities, and this ſettle it cloſe and faſt.

When this has been done over the upper $\frac{2}{3}$ Parts of t Mould, and all the looſe Sa has been drawn back into t lower $\frac{1}{3}$ Part of the Mou that is alſo trampled and ſett

ll over, and levell'd in all Re-pects as the other $\frac{2}{3}$ were, and s loose Sand is drawn off the Mould down into a Place 2 or Inches below the lower End f the Mould, where the Sand s made into 2 Cavities to re-eive the overplus of the Lead.

The Sand being thus levell'd, he next Thing to be done is to mooth it all over with a *smoo-thing Plane* (as they call it) which is a thick Plate of po-lish'd Brass, about 9 Inches Square, a little turn'd up on ll the 4 Edges, so that the Underside looks somewhat like a Diamond cut Looking-Glass, on the upper Side, (which is a little Concave, like a Latten Pan) is a brass Handle solder'd on, upon which is a wooden one also, like a Case-smoothing Iron.

With this Instrument they smooth the Sand all over, put-ting a little Sand in, where there are any small Cavities.

The Sand being thus smoo-thed, the Strike is made ready by tacking (that is by slightly nailing) on 2 Pieces of an old Felt-Hat on the Notches (or else by slipping a Case of Lea-ther at each End) in order to raise the under Side of the Strike about $\frac{1}{8}$ of an Inch, or something more above the Sand, according as they would have the Sheets to be in thick-ness, which will make a mid-dle-siz'd Sheet of about 9 or 10 Pound *per* Foot.

But for Hips and Window Soils, and such Places where it does not lie flat, the Lead need not be above $\frac{1}{10}$ of an Inch thick; but sometimes Plat-Form Lead is near $\frac{1}{6}$ of an Inch thick.

Then they tallow the under Edge of the Strike, and lay it cross the Mould close by the *Pan*, to prevent the Drops of Lead from spattering into the Mould before it be ready to pour.

When the Lead is melted (and the Pan made ready by be-ing lin'd with moistened Sand) it is lav'd into the Pan, in which when there is a sufficient Quantity for the present Pur-pose, they draw off the floating Part with a Piece of Board 2 or 3 Inches broad, or scum off the Mettle round about to the Edge of the Pan, and let it settle upon the Sand, which will by that Means prevent the Sand from falling out of the Pan into the Mould at the pour-ing out the Metal.

When the Metal has been thus prepar'd and cool enough (which is known by its begin-ning to stand with a Shell or Wall round about on the Sand) then 2 Men taking the Pan by the Handle, pour it into the Mould, while a third Man stands (facing them and his right Side to the Mould) ready with the Strike, as soon as they have done pouring in the Metal to put it on the Mould, and so draws off the Overplus of the Lead into the Hollows made to receive it, and then they im-mediately cut off with a Knife the ragged End, before it is cold.

When the Sheet is grown a little cool, they begin to roll it up from the upper End down-wards

wards (they handling it with Pieces of old Felt Hats) and as they roll it up, they rub the Sand off from it.

After they have taken the Sheet off from the Mould, they rake it over with a Rake to let it cool, and then if it be too dry, they ſprinkle it again with Water, but they are very careful that no Part of the Mould be too wet; for if it be, the melted Lead will fly like Shot, when it comes upon it.

After they have rak'd the Sand well, they turn it upſide down with a Shovel, and let it lie ſo a while, and afterwards throw it into $\frac{2}{3}$ Parts of the Mould, and ſettle it down by Treading, as at the firſt *&c.* to make it ready for the next caſting, which is commonly done in an Hour and half or 2 Hours, if the Furnace heat well.

The Weight of a Foot of Sheet Lead.] Every ſquare Foot of Sheet Lead (if it be deſign'd for Gutters, which is commonly run thinner than for Plat-Forms) is reckon'd to weigh 6 or 7 *l.* if Old; 8 or 9 *l.* if New, and every ſquare Foot of Sheet-Lead for Plat-Forms, is reckon'd to weigh 8, 9 or 10 *l.* if Old, and 11 or 12 *l.* if New, and very good.

How much one hundred Weight of Lead will cover.] One hundred Weight of Sheet Lead (at 12 *l. per* Foot) will cover a ſquare Yard, or 9 ſquare Feet, and is a lighter Covering than Tiles, tho' dearer.

Sheet for Gutters.] Sheet Lead that is deſign'd for Gutters, is uſually run thinner than that for Plat-Forms.

Some Plumbers ſay, it is the beſt Way in laying long Gutters, to make a Drip, (fall or Step) about the middle (of 1, 2 or 3 Inches deep) for they ſay, that by this Means the Lead (being cut into 2 Pieces which are ſhorter) is not ſo ſubject to crack (by being dilated and contracted by hot and cold) as otherwiſe it is.

Of laying on Sheet in Plat-Forms.] Plumbers uſe this Method in laying Plat-Forms. When they have roll'd open 2 Sheets, they beat them flat with their Dreſſer, which is a wooden Inſtrument of 16, 18 or 20 Inches long, according as they are in ſtoutneſs, and about 3 or 4 Inches broad at the Bottom, and ſomething more in Height, almoſt in the Form of a *Parallelopipedon*, except that the upper Side is rounded off, and at one End the upper Side is cut away, ſo as to leave a Handle running out ſtrait with the Top.

Then (with a Line of Chalk or with a ſtrait Ruler and a Pair of Compaſſes) they ſtrike a Line, about $2\frac{1}{2}$ Inches diſtant from one Edge of one of the Sheets; this is for the *Standard*.

In the ſame Manner they ſtrike a Line about $3\frac{1}{2}$ Inches diſtant from the Edge next to it of the other Sheet; this is for the *Orlop*.

The *Standard* is about $2\frac{1}{2}$ Inches of a Sheet of Lead, which is ſet up at right Angles to the Sheet all along one Edge of it.

The

The *Orlop* is about 3 ½ Inches of the Edge (next to the Standard) of the other Sheet, raiſ'd up in the Manner of the *Standard*.

Then with their *Pincers* (which are ſomething different from common *Pincers* for theſe have a ſmall Cylinder of Iron of about ½ an Inch Diameter, and 3 or 4 Inches long, fixed to one of the Chaps in ſuch Poſition, that when the Pincers are ſhut, they ſeem to hold it between their Chaps) they raiſe up the *Stander* and *Orlop* by putting the ſharp Chap under the Sheet, and the cylindrical one on the Top near the Line, and ſo they bend up the Edge of the Sheet, both for the *Stander* and *Orlop*.

Next they go on to ſet it in better Order with the *Dreſſer*, with which they make the *Stander* and *Orlop* as upright and ſtrait as they can, by placing one Edge of the *Dreſſer* upon the Line which they ſtruck, and ſtriking hard Blows on the Top of it with a Smith's Hand Hammer.

Having by this Means rendred the *Stander* and *Orlop* as ſtrait as can be, and ſet them up at Right Angles to the Sheet, they bring them together and make a Seam of them, by firſt turning the *Orlop* (which is an Inch broader than the *Stander*) over the *Stander*, by the Help of the *Dreſſer* and *Seaming Mallet*, which is an Inſtrument of Holly, or ſome other hard Wood, wrought away from the Middle to one End, almoſt to a ſharp Edge, and ſo it is likewiſe at the other End, only thoſe Edges ſtand at Right Angles to each other, like a croſs Mattock; and into the Middle of it is put a Handle like a Mallet.

And then they continue to beat the *Orlop*, and conſtantly work upon it with the *Dreſſer*, till they have reduc'd it and the *Stander* into as little Room as they can, by wrapping them one in another, till at laſt it ſeems to be a Kind of Semi-Circle, and this is what they call a Seam.

Some Plumbers ſay they ſometimes lay Plat-Forms of Lead without Seams; but then the Joiſts are wrought in Hollow, about 3 Inches broad, and near as deep in the Form of a Semi-Concave-Cylinder, and when they lay the Sheets down, the Edge of the firſt Sheet lies ſo far beyond the Concavity, and ſo much of the Sheet as lies over the Cavity, is ſet down into it with the ſeaming Mallet, and the next Sheet is laid over that, and ſet down into the Channel alſo; and ſo the Water that comes into thoſe Channels, runs down into the Gutter.

Mill'd Lead.] Some Plumbers ſay, that mill'd Lead is but of little Uſe; not only becauſe 'tis ſo very thin; but alſo becauſe by the milling 'tis ſtretch'd to that Degree, that when it comes to lie in the hot Sun, it ſhrinks and cracks, and (conſequently) will not keep out the Water; being, as they ſay, like Cloth, ſtretch'd on the Cloſiers Tenters, which when

taken

taken off, naturally inclines to return to its former State.

For a Proof of this they refer you to *Greenwich* Hoſpital, which was covered with mill'd Lead, which after it had been done not above 4 or 5 Years, rain'd in almoſt all over the Hoſpital; upon which Account the Maſter and Wardens of the Plumbers Company were ſent for to the Parliament, who ordered them to go and view this mill'd Lead Work at *Greenwich* Hoſpital, which they did, and at their Return to the Parliament, they all unanimouſly declar'd, that mill'd Lead was not fit to be us'd: Whereupon the Parliament had Thoughts of putting down the milling of Lead.

Pipes of Lead.] Some Plumbers give diſtinct Names to their Leaden Pipes, according to their Weight at a Yard long, *e. g.* they have 6 *l.* 8 *l.* 10 *l.* 12 *l.* 14 *l.* and 20 and 28 *l.* Pipes, ſo that a Pipe of 6 *l.* to the Yard, they call a 6 *l.* Pipe

Lead for Glazing.] Some Glaziers ſay, that they uſually allow 50 Pound of turn'd Lead to 100 Foot of Quarry Glaſs: They call it *turn'd Lead*, when the *Came* has paſs'd thro' the Vice, and is thereby made with a Grove on each Side, to go on upon the Glaſs.

The *turn'd Lead* for Quarries is uſually about $\frac{3}{10}$ (which is almoſt $\frac{5}{16}$) of an Inch Broad; and for large ſquare Glaſs, their *turn'd Lead* is $\frac{8}{16}$ or $\frac{1}{2}$ an Inch broad, and they have it of theſe different Sizes $\frac{4}{16}$, $\frac{5}{16}$, $\frac{6}{16}$, $\frac{7}{16}$ and $\frac{8}{16}$ of an Inch broad.

The largeſt Size is for the large Squares, that of $\frac{5}{16}$ for Quarters, and the $\frac{4}{16}$ for crochet Work (or Fret Work as it is called by ſome Glaziers) it being more pliable for that Uſe than broader Lead.

Glaziers can turn Lead of different Sizes in the ſame Vice, by changing their Cheeks for each Size, with another Pair of Spindles, whoſe Nuts almoſt meet or touch; they turn Lead for Tyers, which when it comes out of the Vice, is almoſt cut aſunder in two Thickneſſes, which they can eaſily rend aſunder.

Theſe *Tyers* are very tough; but they are commonly made too ſlight, and therefore, ſome caſt *Tyers* which are ſtouter, but not ſo tough, being more apt to Break in winding.

Of Soldering.] As to the Method of *Paleing* (as they call it) or Soldering on of imboſt Figures on leaden Work; as ſuppoſe, a Face or Head with a Baſs Relief were to be paled on a Ciſtern of a Pump for an Ornament to it.

To perform this, the Plate where it is to be pal'd on, is firſt ſcraped very clean, and alſo the Back-ſide of the Figure, that it may fit cloſe with a good Joint.

Then they place that Part of the Ciſtern (on which the Figure is to be fixed) horizontally, and ſtrew ſome powdered Roſin on the Place where the Joint is made, then a Chaffing-Diſh of Coals being ſet into the Ciſtern juſt under the Place where the Figure is to

ſtand

[H]and, 'till the Rosin is chang'd [r]eddish, and begins to rise in [P]imples or Bladders, they take [a] Piece of soft Solder (made of [a] longish Figure) and rub the [E]nd of it round their Finger, [k]eeping at the same Time [t]heir Finger steady in the [P]lace, so that it may work in[t]o the Joint. And when this [i]s done, the Figure will be well [p]al'd on, and will be as firm as [i]f it had been cast on there.

But if the Cistern, &c. be [s]o thin, as that there may be [R]eason to fear that it will be [t]oo hot, and apt to run or bend, [a]nd yield before the Figure (which is on the out side of it) [w]ill be hot enough; you may [t]hen lay your Figure on the hot Coals, 'till it, and the place to [r]eceive it, are both in a good Temper for *Paling*, and then [s]et the figure on its Place, and [p]roceed to soldering of it as be[f]ore.

In Soldering the Leads of Churches, they sometimes manage it as follows, *viz.* When they solder the Sheets of Lead, which are fixed into the Wall on one Edge, and with the other Edge lap over the Ends of those which are seam'd in the Platform, at every other Sheet, in the middle betwixt the Seams, they Solder the lapping Sheets down to the other thus -----: With one corner of the Scraper [which is an Instrument made of a Plate of Steel in the form of an equilateral Triangle, in the Middle of which is fixed an Iron Strig, on the End of which is fix'd a wooden Knob, or Handle; the Plate is flat on the Side next the Handle, but on the other Side the Edges are ground off with a Bezel like a Chizel, only very obtuse.]

They first mark out (partly on the Edge of the Lapping Sheet and partly on the other) an oblong rectangular Figure, of about 5 or 6 Inches long, and 3 or 4 broad, then they scrape the Metal bright, having first (because it was new Lead) green'd it (as they phrase it) all round about; to prevent the Solder's taking any where but where it has been scrap'd.

This *Greening* is only rubbing it with some green Vegetable, it matters not what, as Cabbage-Leaves, or any green Thing they can get.

After it has been scraped, they rub it with Tallow, and having a red hot Iron ready, they take a Piece of Felt in the Right Hand, and a Piece of Solder in the Left, and holding it against the Iron 'till it drops on the cleansed Place, and when there is enough of it melted they take a Linnen Clout in the Left Hand, and with it keep the Solder continually shoved upon the cleansed Place, and at the same Time work it about with the Iron in the Right Hand, 'till it is pretty well incorporated with the Lead, and so make it up into a kind of swelling Form in Breadth, and then cross the Breadth of it making it into a kind of Seams withe the Point of the Iron.

When this is done, they take Knife and Dresser to knock it

with,

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with, and ſo cut it ſtrait on the Sides and Ends, and what was thus cut off by reaſon of the *Greening* eaſily peeled off.

The Price of Lead in Pigs, ſays Mr. *Leybourn* is uncertain, as from 10 to 20*s.* the Hundred Weight. Sometimes it it is 10, ſometime 12 s. ſometimes 14 s. *per* Hundred Weight. *&c.*

Mr. *Wing* ſays, a Fodder of Lead is $22\frac{1}{2}$ C. Weight, but moſt Authors ſay, but $19\frac{1}{2}$ C. Weight, which is worth from 9 to 12 l. which will caſt 315 Foot of Sheet, at 8 l. *per* Foot.

The Price of Sheet Lead.] Mr. *Leybourn* ſays that in Exchange of Old Lead for Sheets new run, there is commonly allowed 3 s. in every Hundred Weight for Waſte and Workmanſhip.

The Price of caſting Sheet Lead, is commonly about 4 s. *per* Hundred, for caſting Old Lead into Sheets; but if ſo, probably the Plumber (for this Price) makes good ſo many Hundred Weight of Sheet Lead as he received of Old Lead, ſince Mr. *Leybourn* ſays it is done for 3 s. *per* Hundred.

Mr. *Wing* ſays, that there is about 2 s. 6 d. (in every Hundred) loſs in caſting Old Lead into Sheets. He alſo ſays, That caſting Old Lead into Sheets is worth 1 s. 6 d. *per* Hundred.

The Price of laying on Sheet Lead in Roofing, &c.] This, Mr. *Wing* ſays, is worth 15 or 16 s. *per* Hundred Weight, Lead and Workmanſhip. And Mr. *Leybourn* ſays, that, Covering with Lead is uſually valued at 13, 14, or 15 s. *per* Yard Square (according to the Goodneſs of the Lead) or between 7 and 8 Pound the Square of 10 Feet, beſides Solder.

The Price of Solder] This, Mr. *Leybourn* ſays, is 9d. or 10*d.* *per* Pound, as it is allay'd with Lead and ſcalled: For Tin is 10*d.* 11*d.* or 12*d.* *per* pound neat.

The Price of Leaden Pipes. This is Various according to their different Bigneſs.

Some ſay, that for Pipes of half an Inch Diameter in the Bore, they have 1 s. 4d. *per* Yard, $\frac{3}{4}$ of an Inch Pipe, 1 s. 10d. for Inch Pipe, and $1\frac{1}{4}$ Inch Pipe, 2 s. or 2 s. 6 d. (theſe laſt being ſaid to be caſt both in a Mould, only the Inch Pipe has a leſs Bore). For Pipes of an Inch $\frac{1}{2}$ bore, 3 s. 6 d. *per* Yard, and for 3 Inch Pipes, 5 s. or 5 s. 6 d. *per* Yard. *London* Plumbers rate their Pipes according to the Weight of a Yard in Length, their 10 Pound Pipes are 2 s. 2 d *per* Yard.

The Price of turn'd Lead for Glazing is alſo various, according to its Breadth; that of $\frac{7}{16}$ broad has been ſold for 18 s. per Hundred, that of $1\frac{5}{6}$ broad for 17 s.

RED LEAD is the lighteſt of all Reds now in Uſe; it is a Sandy, harſh Colour, and will not eaſily grind very fine, altho much Labour be beſtowed on it.

This Colour is made out of common

Common Lead; having been first reduced to a Litharge, and afterwards ground to Powder in a Mill, 'tis then put into a hot Furnace, made for that Purpose, where it is continually kept stiring with an Iron Rake, 'till it has attain'd a fine Pale-Red Colour; the whole Process of making it may be seen in Mr. *Ray*'s Appendix to his Catalogue of hard *English* Words.

Note, That though this is a Sandy Colour, yet it bears a very good Body in Oil, and binds very fast and firm, being also a quick Dryer.

WHITE LEAD is the Principal of all *Whites*, and owes its Original to the Common Lead used by Plumbers, of which it is made.

The manner of making it at *Venice*, where the greatest Quantities of it are made, is as follows.

They take Sheet Lead, and having cut it into long and narrow Slips, they make it up into Rolls; but so that a small Distance may remain between every spiral Revolution: These Rolls are put into Earthen Pots, so order'd that the Lead may not sink down above half Way, or some small matter more in them; these Pots have each of them very sharp Vinegar in the Bottom, so full as almost to touch the Lead. When the Vinegar and Lead have both been put into the Pot, it is cover'd up close, and so left for a certain Time, in which Space the corrosive Fumes of the Vinegar will reduce the Superficies of the Lead into a white Calx, which they separate by knocking it with a Hammer.

There are two Sorts of this sold at the Colour Shops, the one call'd *Ceruse*, which is the most pure and clean Part, and the other is call'd by the plain Name of *White Lead*.

These Colours work with very much Ease, and will be ground as fine as even the Oil itself, in Comparison, if Time and Pains enough be taken in the grinding of it: It lies very smooth, and binds very hard, on what Work soever it be laid on.

If any Kind of Timber or Stone Work be painted with it, to preserve it from the Weather, it is best to work it in Linseed-Oil, for that will bind it extreme hard, if it be laid stiff upon the Work; but if *White Lead* be us'd alone within Doors, it will then be best to mix it with drying Nut Oil; for Linseed Oil, within Doors, will turn yellow, and spoil the Beauty of it; which Inconvenience Walnut Oil made to dry, prevents, for that makes it keep a constant whiteness.

LEDGERS, See *Putlogs*.

LEMMA [in *Geometry*] is a Term us'd chiefly by Mathematicians, and signifies a Proposition, which serves previously to prepare the Way for the more easy Apprehension of a Demonstration of some Theorem, or for the Construction of some Problem.

LENS [in *Opticks* and *Dioptricks*] is any Glass that is not very thick, which either

collects the Rays of Light into a Point, in their Paſſage thro' it, or diſperſes them farther apart, according to the Laws of Refraction.

Lenſes have various Figures; that is, they are terminated by various Circumſtances, from whence they acquire various Names.

Some are Plane on one Side, and Convex on the other; others Convex on both Sides, which are both uſually rank'd among the Convex *Lenſes*, tho' in accurate Speaking, the former is call'd *Plano Convex*.

Some are Plane on one Side, and Concave on the other, and others are Concave on both Sides, which are uſually call'd *Concave Lens*, tho' when diſtinguiſh'd, the former is call'd a *Plano Concave*.

Others are Concave on both Sides; others are Concave on one Side, and Convex on the other; which are call'd *Convexo Concave*, or *Concavo Convex Lenſes*, according as the one or other Surface is more Curve, or a Portion of a leſſer Sphere.

LEVEL, A Mathematical Inſtrument, ſerving to draw a Line parallel to the Horizon; to lay off Floors, the Courſes of Maſonry, &c. Horizontally, to meaſure the Difference of the Aſcent or Deſcent between ſeveral Places, to convey Waters, drain Fens, &c.

Carpenters LEVEL conſiſts of a long Ruler, in the middle whereof is fitted at Right Angles, another ſomewhat bigger, at the Top of which is faſtened a Line; which when it hangs over a fiducial Line at Right Angles with the Baſe, ſhews that the ſaid Baſe is horizontal.

Maſons LEVEL, is compos'd of 3 Rules, ſo join'd as to form an Iſoſceles Rectangle, ſomewhat like a Roman A; at the Vertex whereof is faſtened a Thread, from which hangs a Plummet; which paſſes over a fiducial Line, marked in the middle of the Baſe, when the Thing to which the *Level* is apply'd, is horizontal; but declines from the Mark when the Thing is lower on one Side than the other.

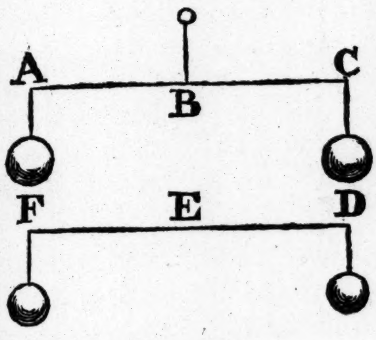
LEVELLING, is the Art of finding a true Horizontal Line; or the Difference of Aſcent or Deſcent between any 2 Places, or to determine the Height of one Place with Reſpect to another, for the laying of Grounds even, regulating of Deſcents, draining Moraſſes, conducting of Waters, &c.

The LEVER is no other than the *Ballance*, excepting the Manner of its Application in Practice.

LEVER [in *Mechanicks*] an inflexible Right Line, ſupported by a ſingle Point on a *Fulcrum* or Prop, and us'd for the raiſing of Weights; being either void of Weight it ſelf, or at leaſt having ſuch a Weight as may be balanc'd. The Lever is the firſt of thoſe call'd *Mechanical Powers*; or *Simple Machines*, being of all others the moſt Simple, and is chiefly apply'd for raiſing of Weights to ſmall Heights; that

is,

is, as the Ballance is suspended or hung on the fixed Point or



Centre of Motion, as A C on B, the *Lever* rests upon a Point as D F on E, which is also call'd either the fix'd Point, *Centre of Motion*, *Fulcrum* or *Fulcimen*.

There are 4 Kinds of *Levers* in Use, call'd a *Lever* of the first Kind, a second Kind, a third Kind, and a fourth Kind.

A *Lever* of the first Kind is that whose *Fulcrum* is between the Power apply'd, and the Weight that is to be rais'd, as

A C, where the Power is apply'd at C, the Weight A, and the *Fulcrum* between them, as at B.

The Weight which may be rais'd by this *Lever* with a given or known Power or Strength apply'd at C, may be known by the following Canon or Analogy:

As the lesser Brachia A B, being always contain'd between the middle of the Lever, and the Weight to be rais'd, is to the greater Brachia B C,

So is the Power apply'd at C, to the Weight that it will raise at A.

Suppose the Lever A C to be 12 Foot long, and the Power apply'd, = 10 Pound Avoirdupoise, and let the Fulcrum B be at 9 Foot Distance from C.

Then I say,
As 3 the lesser Brachia,
Is to 9 the greater Brachia,
So is 10 the Power apply'd at C, to 30 the Weight that C will raise at A.

The *Operation*.

3 9 10 30
9
3) 90 (30

And here observe, that the nearer the Fulcrum is plac'd to the Weight, the greater Weight can be rais'd,

As for Fxample,
Suppose the *Fulcrum* be plac'd at 10 Feet Distance from C at E, then I say,
As A E 2, the lesser Brachia,
is to E C 10 the greater Brachia,
So is 10 the Power, apply'd at C to 50, the Weight that C will raise at A.

The *Operation*.

2 10 10 50
10
2) 100 (50

Now 'tis plain, that by moving the *Fulcrum* one Foot nearer towards the Weight, the Power is increas'd from 30 to 50, and therefore to Equipoise the Weight A on the *Fulcrum* E, then is but 6 Pounds requir'd, as a Power at C. For:

As E C 10 Feet the greater Brachia, is to A E 2 Feet.

So is 30 the Weight A, to 6 the Power requir'd at C, to equipoise A.

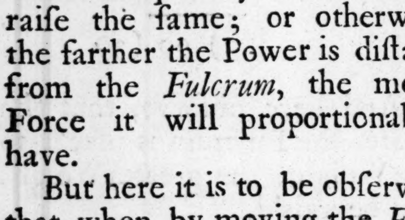
The *Operation*.

$$\begin{array}{cccc} 10 & 2 & 30 & 6 \\ & & 2 & \\ \hline & & 10)\,60\,(6 & \end{array}$$

Hence it is evident that the nearer the *Fulcrum* is to the Body or Weight, the lesser Power it requires to equipoise the same, and consequently the lesser to raise the same; or otherwise the farther the Power is distant from the *Fulcrum*, the more Force it will proportionably have.

But here it is to be observ'd, that when by moving the *Fulcrum* near to the Weight by which the Power is increas'd, that at the same Time the Space or utmost Height of raising the Weight is diminished accordingly.

Let I L be *Lever* 12 Foot long, with its *Fulcrum k*, at 9



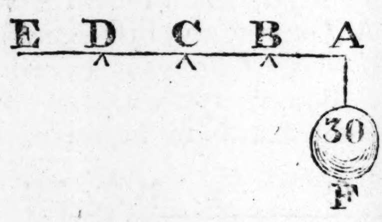
Feet from *l*; then if the Point *l* be depress'd to *m*, it will raise the Body *i* unto *l*, on the horizontal Line *c d*.

But if the Weight or Body *i* be mov'd nearer to *k* as at *h*, whereby a lesser Power will raise it, than when the End of the Lever *l* is depress'd, as before to *m*, the Body *h* will be rais'd no higher than *b* on the horizontal Line *e f*.

And again, had the Body *i* been plac'd at *n*, it could not be rais'd higher than *m*, on the Line *o p*, and so in like Manner of all others, QED.

Hence 'tis plain, that the higher the Body is rais'd, the greater Distance it must be from the *Fulcrum*, and consequently the greater Strength or Power is requir'd to raise the same.

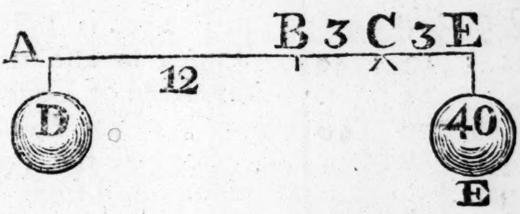
Whence it is evident, that as the Distance of the Weight from the *Fulcrum*, may be greater as B C, than the Distance



of the Power A B, or lesser (as A B) than the Power B C or equal to one another, as A B, and B C in the Ballance Figure 9; so proportionably must the Powers be apply'd.

Suppose that A E is a Lever 12 Foot long, that the *Fulcrum* be fix'd at C, 3 Feet from E the Place where the Power is to be apply'd, and that the Body F hanging at E, weighs 30 Pounds; what Power at A will equipoise E, and by what Analogy is it to be found?

Answer



Answer. The Analogy is as follows.

As C E 3, the lesser Brachia, is to C A 9, the greater Brachia,

So is 40 the Weight E, to 90 the Power required at E, to equipoise the Body F at A.

Operation.

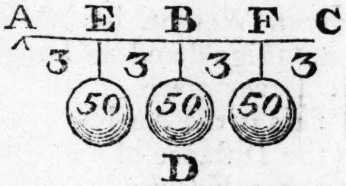
3 9 40 120
9

3)360(120

Hence 'tis plain, that this Analogy is the same as the first Analogy of the Lever of the first Kind; for if you suppose that the Body E be a Power given, then the Power requir'd to equipoise the same, is no more than to find the Weight or Power that the given Weight will equipoise.

This may suffice as to the Lever of the first Kind.

A LEVER of the Second Kind, is one wherein the first Point or *Fulcrum* is plac'd at



one End (as at A) the Power apply'd at the other End (as at C) and the Weight suspended between them, as at E B F, *&c.*

The following Canon or Analogy, will give the Weight that any given Power will raise, or what Power is requir'd to raise a given Weight; that is to say,

As the Distance of the Weight from the *Fulcrum*,

Is to the Distance of the Power from the *Fulcrum*,

So is the Power of the Weight that will equipoise it. And here note, that when the equipoise of any Weight is found, a very small Addition thereto is the Power that will raise it.

Let the Power at C be = 10 Pounds Averdupoise, and the Lever A C be = 12 Feet in Length, and let the Body D be hung in the Middle at B, 6 Feet Distant from the Power C, as well as from the *Fulcrum* A. Then I say,

As B C, 6 Feet Distance of the Weight from the Power, is to A B 12 Feet, the Distance of the Power from the *Fulcrum*, so is 10 Pounds the Power at C to 20 Pounds in *Æquilibrio.*

Again.

Let the Body D be mov'd to E, at 3 Feet Distance from the *Fulcrum* A. Then I say,

As A E 3, the Distance of the Weight from the *Fulcrum*,

Is to A C 12, the Distance of the Power from the *Fulcrum*,

So is 10 the Power apply'd at C, to 40 its *Æquilibrium.*

 The

The *Operation*.

As 3 : 12 : 10 : 40
12

3) 120 (40

Again.

Let the Body or Weight D be mov'd to F, at 9 Feet Distance from the *Fulcrum* A;

Then I say,

As A F, 9 Feet the Distance of the Weight from the *Fulcrum*,

Is to A C, the 12 Feet, the Distance of the Power from the *Fulcrum*,

So is 10 the Power apply'd at C to 13 and a half its *Æquilibrium*.

The *Operation*.

9 : 12 : 10 : 13 + 3 qurs.
12

9) 120 (13 3 qurs.

Hence it is also evident, as in the *Lever* of the first Kind, that the nearer the Weight is to the *Fulcrum*, the greater is the Power increas'd.

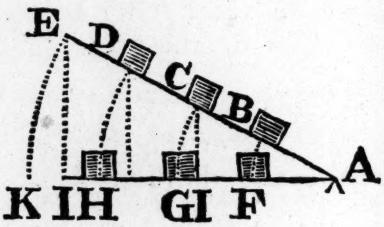
For in this last Example, where the Weight was apply'd at F, 9 Feet Distance from the *Fulcrum* A, the Power C 10 would equipoise but 10 Pounds 3 Quarters; but where the Weight was apply'd nearer to the *Fulcrum*, as at B, 6 Feet from the *Fulcrum* A; then its epuipoise was equal to 20 Pounds.

And again, when the Weight was apply'd still nearer to the *Fulcrum*, as at E, then the equipoise at C was = 40 Pounds, Q E D.

And as has been already prov'd in the Lever of the first Kind, that what is gain'd in Power, is lost in Space or Time; so also 'tis the same in this Kind of Lever.

For *Example*.

Suppose the Power at K, is to be rais'd from K to E, = 6 Feet above I, and at the same Time was to raise the Weight



G, plac'd in the middle of it; Then I say, that though the Weight equipois'd at C, is double to the Power E, yet G is rais'd but half the Height of E, above I; that is, as the equipoise G, rais'd to C, is double the Weight of the Power K, rais'd to E.

So is the Space or Arch E K through which the Power K pass'd in going to E, double or = twice the Space or Arch G C, through which the Body or Weight G pass'd in going to C, and so in like Proportion of all others, according to their Distance from the *Fulcrum*.

Now to find a Power equal to a given Weight, having the *Fulcrum* assign'd, and the Length of the Lever given.

This is the Analogy.

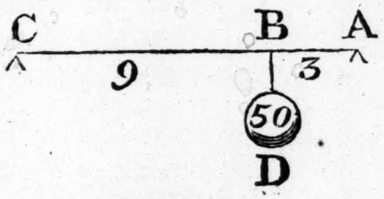
As the Distance of the Power from the *Fulcrum*,

Is to the Distance of the Weight from the *Fulcrum*, so is the given Weight to the Power requir'd to equipoise the same.

Let

Let the given Weight D, be = 50 Pound, plac'd at E, 3 Feet distant from the *Fulcrum* A, and let the Power be apply'd at C, 12 Feet distant from the *Fulcrum* A, then I say,

As 12 the Distance of the Power from the *Fulcrum*, is to A E 3, the Distance of the Weight from the *Fulcrum*, so is 50 the given Weight of the Body D to 12 and half the Power requir'd at C, to equipoise D.



Operation

As 12 3 50
3
12) 150 (12½
12
30
24
6
6
6 12½

Question. When with a Lever of the Second, raises a Body of 50 Pound Weight, with a Power = to 25 Pound, what sustains the other 25 Pounds?

Answer. The *Fulcrum* on which it rests. For Proof,

Suppose that A and B were 2 Powers, sustaining the Weight B at D, 3 Foot from A. As the Weight D is nearer to the Power at A, than to the Power at E, therefore the Power at A, sustains the greater Part of the Weight.

Demonstration.

I suppose A to be the only Power, and C the *Fulcrum* and let the Lever A C be = 12 Feet.

Then I say as before,

As A C 12, the Distance of Power A from the *Fulcrum* C,

Is to B C 9, the Distance of the Weight D from C.

So is D 50, the given Weight to 37 and a half, the Power requir'd at A to equipoise B.

Operation.

12 9 50 37½
9
12) 450 (37½
36
90
84
6 = ½

Hence 'tis evident, that the Power A sustains 37 and half Pounds of the Weight B, which is = 50 Pounds.

Again.

Suppose A to be the *Fulcrum*, and C the Power with the Weight as before.

Then I say.

As C A 12 the Distance of the Power C from the *Fulcrum* A,

Is to A B 3, the Distance of the Weight from the *Fulcrum*.

So is D 50, the given Weight to 12 and a half the Power requir'd to equipoise D.

 The

The *Operation*.

12 3 50 $12\frac{1}{2}$

3

12) 150 ($12\frac{1}{2}$

12

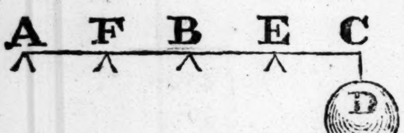
30

24

$6 = \frac{1}{2}$

Hence 'tis evident, that the Power C ſuſtains but $12\frac{1}{2}$ Pounds. Now if to $37\frac{1}{2}$ be added $12\frac{1}{2}$, the Sum is = 50, the given Weight ſuſtain'd by A and C. Q E D.

The LEVER of the third Kind hath its fix'd Point or



Fulcrum, at the other End, as D at G, and the Power apply'd at any Part between them, as E B F, &c.

Now ſeeing that the Power apply'd muſt be always between the 2 Ends; therefore it follows, that the Power muſt always exceed the Weight to be rais'd, or otherwiſe no Weight can be rais'd thereby.

Suppoſe the Lever A C = 12 Foot, A the *Fulcrum*, and at C is plac'd the Weight D = 50 Pounds. I ſay, that if the Power be apply'd in the middle at B, it muſt be = 100 Pounds Weight to equipoiſe D.

For the *Fulcrum* being fix'd at A, it makes a Reſiſtance equal to the Weight D, or rather a greater; or otherwiſe the Power at B could not raiſe it. Therefore

As A B 6, the Diſtance of the Power from the *Fulcrum*,

Is to A C, 12 the Diſtance of the Weight from the *Fulcrum*,

So is 50 the given Weight D, to 100, the Power requir'd at B, to equipoiſe D at C.

Secondly. Suppoſe the Power to be apply'd at E, 3 Feet from the *Fulcrum* A;

Then I ſay,

As 3 Feet, the Diſtance of the Power from the *Fulcrum*,

Is to 12 Feet, the Diſtance of the Weight from the *Fulcrum*,

So is 50 the given Weight to 200, the Power requir'd at E, to equipoiſe D at C.

Again.

Suppoſe the Power to be apply'd at E, 9 Feet from the *Fulcrum* A;

Then I ſay,

As 9 Feet the Diſtance of the Power from the *Fulcrum*,

Is to 12 Feet the Diſtance of the Weight from the *Fulcrum*,

So is 50 the given Weight to 66 3 qrs, the Power requir'd at E, to equipoiſe D at C.

Now from theſe Examples 'tis alſo evident, that the farther the Power is apply'd from the *Fulcrum*, the leſſer the Power is requir'd, tho' always greater than the Weight rais'd.

But however, tho' this Kind of Lever doth loſe in its Power, contrary to both the others, yet it does not loſe in Time or Space alſo, as they do; but on the contrary, it gains in Space or Time proportionably.

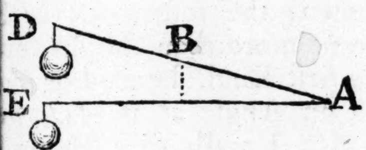
As for *Example*.

Let A E be a Lever = 12 Foot

Foot, A the *Fulcrum*, E the *Weight*; and the Power apply'd in the middle at C.

Then I ſay, if the Power C raiſes the Lever A E, with the Weight E into the Poſition A B D, then will E have paſs'd the Arch E D, which is equal to twice the Arch B C, through which the Power C hath mov'd.

For ſince that A C is = A E; Therefore as A H is to H B, ſo is twice A h (that is A h + *h g*) to *g* D, which is =



to twice B *h* the Triangle A B *h* and A D *g* being ſimilar, Q. E. D.

This Kind of Lever is chiefly us'd in the Regulators of Water Engines, where it is required to ſtrike a greater Stroke, than that of the Crank, as at *London Bridge*, where the Power of the Crank Rods are apply'd between the forcing Rods and the *Fulcrum* of the Regulator.

This Lever is alſo ſhewn by the raiſing of a Ladder, when the Power is apply'd in the middle; the End reſting, or kept down on the Ground, as the *Fulcrum*, and the Weight beyond the Power, is the Weight requir'd to be rais'd.

Q. But ſuppoſe a Power is given with its Diſtance from the *Fulcrum*, as alſo the Length of the Lever, how is that Weight to be found, which the given Power can equipoiſe?

A. This is found by the following Canon or Analogy.

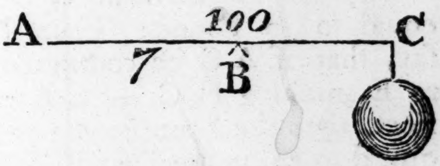
Suppoſe the given Power to be 100 Pounds, apply'd at 7 Feet Diſtance from the *Fulcrum*, and that the Length of the Lever is = 12 Foot.

Analogy.

As the Diſtance of the Weight from the *Fulcrum*,

Is to the Diſtance of the Power from the *Fulcrum*,

So is the Power apply'd to the Weight it will equipoiſe.



Then I ſay,

As 12 the Diſtance of the Weight from the *Fulcrum*, is to 7, the Diſtance of the Power from the *Fulcrum*,

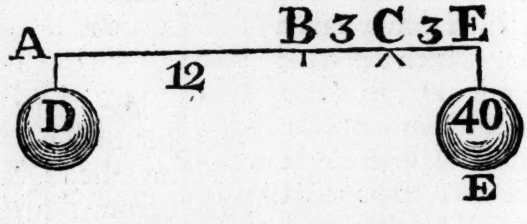
So is 100 the Power apply'd at B, to 58 3 *qrs*. the Weight at C, which it can equipoiſe.

The *Operation*.

12 7 100
7
———
12) 700 (58, 3 *qrs*.
60
———
100
96
———
4 = 1 *qr*.

If a Lever of the third Kind, as C A, be continued beyond the *Fulcrum* = to the Diſtance of the Power apply'd (ſuppoſing B, the Power given) that is

is making E C = to C B, then it will become a Lever of the first Kind, and the same Power which was apply'd at B, as a Lever of the third Kind, being apply'd at E, as a Lever of the first Kind, will have the same Effect in equipoising the Body D, as when at B.



Suppose C A = 12 Feet, C B = 3 Feet, and let the Weight D sustain'd at A be equal to 10 Pound: Then I say, that if A C be continued to E, making E C = C B 3 Feet, then the same Power requir'd to equipoise D at B, being apply'd at E, will equipoise D also.

Demonstration.

First, considering E A as a Lever of the first Kind, whose *Fulcrum* is C, and let the Weight D be = 10 Pounds.

Then I say,

As E C 3, is to C A 12 : : So is D 10, to E 40, which is the equipoise of D, apply'd at E.

Again.

Considering C A as a Lever of the third Kind, with the Power apply'd at B, 3 Feet from the *Fulcrum* C.

As C A 12 is to C B 3 : : So is 40 apply'd at B to 10 its Equipoise at A.

Or as C B 3, is to C A 12 ; so is 10 the Weight at A, to 40 the Power apyly'd at B. Hence it is plain, that the same Power has the same Effect, either at E or B. Q E D.

These are the only distinct Kinds of Levers that are yet known; the fourth Lever being no more than the Lever of the first Kind, bended or making an Angle at its *Fulcrum*, as the Handle of a Hammer considered with its Head and Claws, when us'd in drawing a Nail, for then its Head is the *Fulcrum*, and it being between the Claws that lay hold of the Nails and that Part of the Handle, where the Hand or Power is apply'd to draw the Nail, does therefore become a real Lever of the first Kind.

And tho' 'tis call'd a Lever of the fourth Kind, or the bended Lever, yet it is no more than a Lever of the first Kind, and the Analogies thereof are the same in all Respects.

N. B. That in the Practice of all these Operations, there has been no Allowance made for the real Weights of the Levers themselves, as has been noted; but therefore it must always be remembred in Practice, to make an Allowance for their own Weights, exclusive of the Powers apply'd.

LIGHTS [*in Architecture*

re underſtood of the openings of DoorsGates and Windows,and other Places through which the Air and Light have Paſſage.

LIME, calcin'd Stone, Marble, Free-Stone, Chalk, or other Matter, burnt in a large Fire in a Kiln or Furnace built for that Purpoſe; to be afterwards uſed in the Compoſition of Mortar for Building, the Fire taking away all its Humidity, and opening its Pores, ſo that it becomes eaſily reducible to Powder.

Mr. *Leybourn* tells us out of *Palladio*, That Stones, whereof Lime is made, are either dug out of Hills, or taken out of Rivers: That Lime is beſt, that is made out of the hardeſt, ſound, and white Stones, and being burnt, remains a third Part Lighter than the Stones whereof it is made.

All dug Stones are better to make Lime of than gathered Stones; and from a ſhady and moiſt Pit, than from a dry.

All Stones are ſooner or later Burnt, according to the Fire which is given them; but they are ordinarily burnt in ſixty Hours.

Sir *Henry Wootton* looks upon it as a great Error in the *Engliſh*, to make Lime as they do, of Refuſe and Stuff without any Choice, whereas the *Italians* to this very Day, and much more the Ancients, burnt their firmeſt Stones, and even Fragments of Marble, where it was plentiful, which in Time became almoſt Marble again, for Hardneſs, as appears in their Standing Theatres, *&c.*

There are two Kinds of Lime in Common Uſe in *England*, the One made of Stone, and the other of Chalk, whereof the former is much the Strongeſt.

That which is made of ſoft Stone or Chalk, is the fitteſt for Plaiſtering of Ceilings, and Walls within Doors; and that made of hard Stone, is fit for Structures or Buildings, and Plaiſtering without Doors, that lie in the Weather.

And that which is made of a greaſy, clammy Stone, is ſtronger than that made of a poor lean Stone; and that which is made of a ſpungy Stone, is lighter than that made of a firm and cloſe Stone; that is again more Commodious for Plaiſtering, this for Building.

Good Lime may alſo be made of Mil-Stone, but not coarſe and ſandy, but fine and greaſy: as likewiſe of all Kinds of Flints; tho' 'tis hard to burn them, except in a Reverberatory Furnace as being apt to run to Glaſs, unleſs thoſe that are roll'd in Water, becauſe the greateſt Part of its Increaſe goes away by a Kind of Glaſs.

Dieuſſant recommends *Lime* made of Sea Shells, as Cockle, Oyſters, *&c.* as the beſt; but *Goldman* findes Fault with it, as being impatient of Moiſture, and therefore eaſily peeling off from the out-ſide Walls: However, it is the Common Lime uſed in the *Indies*.

About *Suſſex*, *Lime* is made of hard Chalk digged out of the Hills, and is burnt in Kilns

like

like Brick-Kilns, but with this Difference, that they have no Arches in them; but only a kind of Bench or Bank, on each Side, upon which they lay the largest Stones, and so truss them over and make an Arch, after the Manner of Clamps for Bricks, and when they have thus made an Arch with the largest Stones, they fill up the Kiln with the smaller ones.

Some have said that *Kentish Lime* is far better than that commonly made in *Sussex*; because they say, a Gallon of Water will make as much more *Kentish* Lime run, as it will of *Sussex* Lime; so that it should seem (by the Consequence) that, that is the best *Lime* which will run with the least Moisture.

Before the Stones are thrown into the Kiln, they are to be broken to Pieces; otherwise the Air contained in their Cavities, too much expanded by Heat, makes them fly with so much Violence as to damage the Kilns.

Alberti and *Palladio* say, that Lime will not be sufficiently burnt in less than Sixty Hours; and *Alberti* gives the Marks of a well burnt Lime to be as follows, *viz.* that its Weight is to that of the Stone in a sesquialterate Proportion; that it is white, light and sonorous; that when slaked, it sticks to the Sides of the Vessel. To which *Boeckler* adds, that when slaked, it sends forth a copious thick Smoak; and *Dieussant*, that it requires a great deal of Water to slake it.

Walter Burrel of *Cuckfield* in *Sussex*, Esq; was the First that introduc'd the Use of *Fern* for burning of Lime, which serves that Purpose as well as Wood, (the Flame thereof being very vehement) and is far cheaper.

In order to preserve Lime several Years, slake and work it up; dig a Pit under Ground, into which let it pass through a Hole open at the Bottom of the Vessel: As soon as the Pit is full, cover it up with Sand, to prevent its drying; thus keeping it moist 'till it be used.

Boeckler gives another Method. Cover a Stratum or Layer of Lime Two or Three Foot high with another of Sand of the like height; pour on Water enough to slake the Lime, but not to reduce it to Dust after slaking. If the Sand cleave into clush as the Smoak ascends, cover them up, so as no Vent may be given thereto.

He says, that this Lime, being kept 10 or 12 Years, will be like Glue, and will further be of particular use in painting Walls, as being no way prejudicial to the colours.

Quick LIME, or unslak'd Lime, is that which is as it comes out of the Furnace.

Slak'd LIME, is that wash'd or steep'd in Water, and reserv'd for the making of Mortar.

Lime is commonly sold about *London* by the Hundred, which is 25 Bushels, or 100 Pecks; but in the Country, by the Load, of 32 Bushels.

A Load of Lime, as some say,

say, will make Mortar enough for 250 solid foot of Stone-work; and 8 Bushels of Lime, heap'd Measure, is the common Allowance to every thousand of Bricks.

The Price.] The Price of Lime differs according to the Places, as from 8 to 12 *s.* the Hundred.

Before the late Wars, which have made Fuel scarce (says a certain Author) *Lime* in some Parts of *Sussex* has been sold for 20 or 21 *s. per* Load, 32 Bushels to the Load, but since, in some Parts of *Sussex*, it has been sold for 24 or 25 *s. per* Load, and in others for 32 *s.*

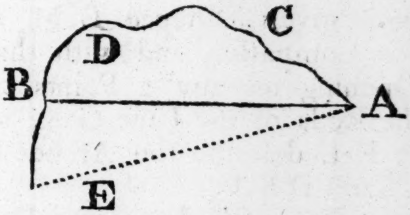
Yet in some Parts of *Sussex* it is still sold for 12 *s. per* Load at the Kiln, and for about 15 *s.* 6 *d.* laid in 3 or 4 Miles.

LIME-STONE, is a Stone of a whitish Colour, which being burnt in a Kiln, enters the Composition of Mortar, Plaister, &c.

LIMITED Problem, is one which has but one, or a determined Number of Solutions; as to make a Circle pass thro' 3 Points given, not lying in a right Line; to describe an equilateral Triangle on a Line given.

LINE, according to *Euclid*, is a Longitude without Latitude, or a Length without Breadth or Thickness.

A Line is generated by the

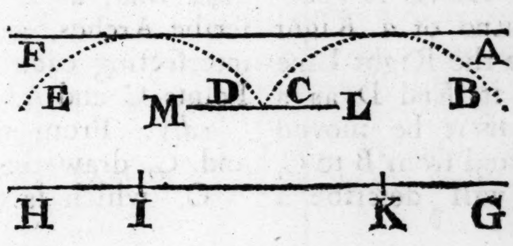


Motion of a Point from one Place to another. Thus the Point A moving directly from A to B, generates the right Line A B; therefore a right Line is the nearest distance between two Points, which are the Bounds or Limits of it.

But had the Point A in going to B first gone to C, and thence to D, and afterwards to B, it would by its irregular Motion have described a crooked Line, as A C D B; which being irregular without any Respect to a Centre, is therefore call'd an irregular curv'd Line.

If the right Line A B be fix'd at the Point A as a Centre, and afterwards the End B be moved to E, it will by its Motion generate or trace the crooked Line B E; and because that all the Parts of that crooked Line are at equal Distance from A, the Centre whereon it was describ'd is therefore called a Regular curved Line.

A RIGHT LINE, G H being given to draw the Right Line A F, parallel at the given Distance of the Line L M,



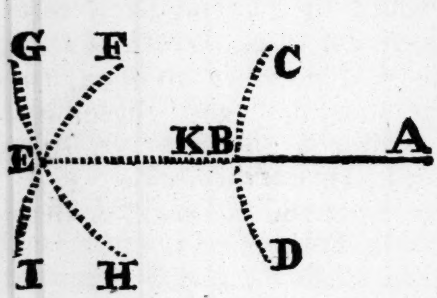
First,

First take the Length of your given Diſtance L M, in the Compaſſes, and with that Opening on any 2 Points, in the Ends of the Line G K, as at H I, deſcribe the Arches B C, and D E.

2. Lay a Ruler to the Extremes of thoſe Arches, and draw the Right Line A F, which will be parallel to G K, as requir'd.

The Right LINE A K of a certain Length being given to continue the ſaid Line A longer to E.

1*ſt*. On A with a opening of your Compaſſes, deſcribe an Arch, as C D; and from the

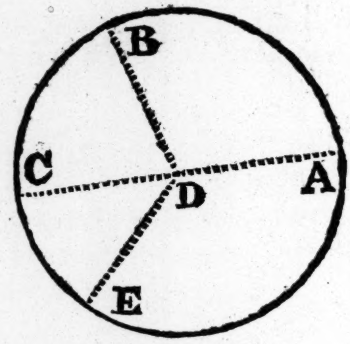


Point of Interſection, ſet off on the Arch any equal Diſtances to C and D.

2*d*. With any large Diſtances greater than D B, on the Points D and C deſcribe Arches, as F I and G H, interſecting each other in E.

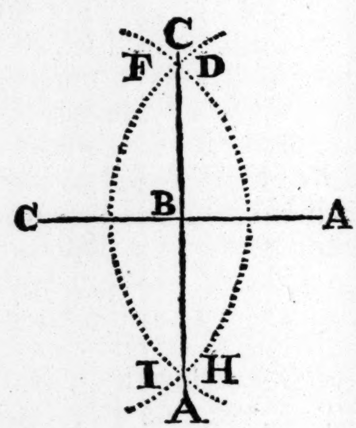
3*d*. From the Point B to the Point E, draw the Right Line B E the Continuation requir'd.

A Circular LINE is generated by the End of a Right Line. Suppoſe the Right Line A D, fix'd at its End D as a Centre, then if it be moved from A to B, and from B to C, its End A, will deſcribe a



Curv'd or Circular Line A B C, which is alſo call'd an Arch of a Circle; for was the Point C to be mov'd on to E, and from thence to A, it would compleat a round Space A B C E A, which is called a Circle.

To divide a Right Line A C into two equal Parts by the perpendicular A C.

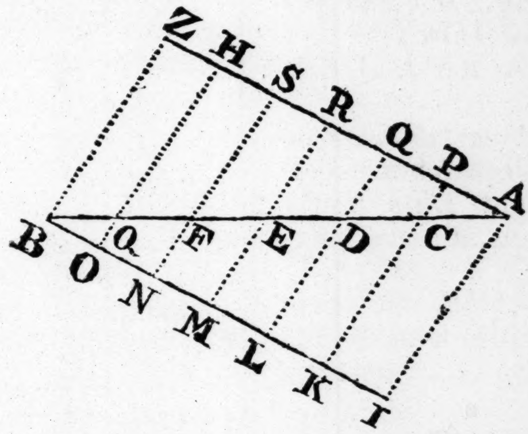


1*ſt*. Open the Compaſſes to any Diſtance greater than half the given Line A C, and at each End, as at A and C deſcribe Arches, as D B and F I, interſecting each other in the Points C and A.

2*dly*. From the Points A and C, draw the Right Line A C, which is the Perpendicular

cular requir'd, which will divide A C into two equal Parts, at the Point B.

To divide the Right LINE A B into any Number of equal Parts, as suppose 6.



1*st*. From one End of the given Line A B, draw another Right Line, as A B from A, making any Angle at Pleasure; then from the other End, as B, draw the Right Line B I, parallel to it, or make the Angle A B I = to the Angle H A B.

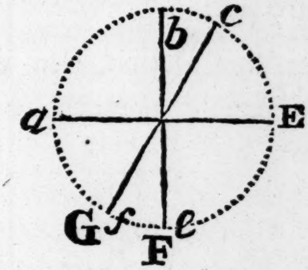
2*dly*. Open the Compasses to any Distance, suppose A P, and as the Line is to be divided into 6 Parts; therefore set off 6 of those Distances on the Line A Z, at the Points P Q R S H, as likewise the same on the Line B I, at the Points O N M L K.

3*dly*. Draw the Lines P K Q L R M S N, and H O, and they will divide the Line A B into 6 equal Parts, at the Points C D E F G, as requir'd.

Theorem.

If any 2 Right LINES cut tho' one another, as A E cut by *b* F or *c* G, then are the opposite or vertical Angles equal to one another.

For *b* F cutting A E at right Angles, the Angle *a* B *b*, and *b* B *d* are equal, so also the Angle *b* B *d* is equal to the Angle *d* B *e*; and *d* B *e* to *e* B *a*; therefore they are all equal to one another, and therefore their opposite Angles are also equal; that is the Angle *b* B *d* is equal to the Angle *e* B *a*, and



the Angle *a* B *b* is equal to the Angle *e* B *d*, because the Arches *a b*, *b d*, *d e e*, *a*, by which they are measured, are severally and oppositely equal.

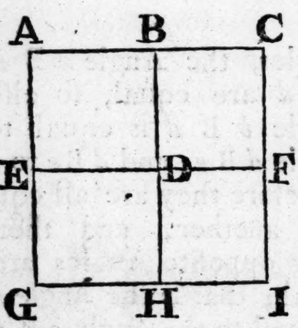
Again, The Angles *c* B *d* and *a* B *f* constituted by the Right Line *c* G, cutting A E in B are equal; because the Arches *c d*, being of the same Radius with

with the Arch *f*, *a*, and equal thereto, are therefore equal to one another. So also are the opposite Angles *a* B *c*, and *f* B *d*; because the Arch A C, is equal to the Arch *f d*. Q E D.

Theorem.

When a Right LINE *is divided into 2 equal Parts, the Squares made of those Parts, are equal but to half the Square made by the whole Line.*

This is evident; for the 2 Squares A B E D and B C D. F, made by the Squares of



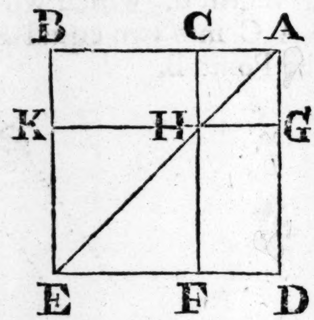
the 2 equal Parts of the Line AC, are equal but to half the Square, A C G I, made by the Square of the whole Line A C; because that the other 2 Squares, D H F I, and E D G H, are equal unto them. Q E D.

Theorem.

When a Right LINE *is divided by Chance into 2 unequal Parts, the Square of the whole Line is equal to both the Squares made of the Parts; and to the 2 Parallelograms, comprehended under the same Parts also.*

That is, if the Right Line B A be accidentally divided in C, I say that the Square A B D E, is equal to the Squares

L I



made of the Parts (A C G H and H K F E) and the 2 Pa rallelograms C B H K, and H D F also, whose oppos Sides are equal to the unequ Parts of the divided Line B; because that the whole equal to all its Parts taken t gether; which being evide needs no further Demonstr tion.

Corollary.

Hence it appears, that t Parallelograms comprehend under the unequal Parts of t Line A B, *are equal to one a other.*

For since that the Diago A H E doth divide the Squa into two equal Parts, a thereby the Triangle A B E, made equal to the Triangle D E; so is also the Triangle C H, equal to the Triangle G E; and the Triangle H E, to the Triangle H F

Now if from the 2 Triang A B E and A D E you subtra or take away the equal Tria gles A C H, A G H, H F and H K E, the Remains w be equal; for if from equ Quantities you take aw equal Quantities, the Quan ties remaining will be equal.

Note, That the Squares A G H and H K F E, are ge ra

lly call'd the Parallelograms, out the Diameter A E; but ay be more properly call'd e Squares about the Diagol A E; because they are real- Squares, and not Parallelograms; and the Line A E is a Diagonal common to them oth, and not a Diameter, as is call'd by *Euclid*, in his urth Proposition of his Send Book.

The Parallelograms C B H , and G H D F, are call'd e Supplements or Complements of the two Squares A G H, and H K F E, to the hole Square A B D E.

LINE *of Direction* [in *Mechanicks*] is that according to hich a Body endeavours to ove.

Horizontal LINE [in *Perspective*] is the common Section f the Horizontal Plane, and at of the Draught or Representation, and which passes rough the principal Point.

Geometrical LINE [in *Perspective*] is a Right-line drawn ny how on the Geometrical lane.

Terrestrial LINE [in *Perspective*] is a Right-line where- the Geometrical Plane and at of the Picture or Draught terfect one another.

Terrestrial LINE [in *Perspective*] which is also called e *Base Line*, or *Line of the lane*, is the Line that an Obct is plac'd or stands upon, hereof each Object has its rticular one, and the whole raught a general one.

This is always parallel to the orizon, and sometimes serves to determine the Lengths and Breadths, particularly that at the Bottom of the Piece, whereto all the Measures are to be accommodated.

Objective LINE [in *Perspective*] is the Line of an Object from whence the Appearance is sought for in the Draught or Picture.

LINE *of the Front* [in *Perspective*] is the common Section of the vertical Plane and of the Draught.

LINE *of Station* [in *Perspective*] is, according to some Writers, the common Section of the vertical and geometrical Planes. Others mean by it the perpendicular Height of the Eye above the geometrical Plane: Others a Line on that Plane and Perpendicular to the Line expressing the Height of the Eye.

LINE *of Gravitation of any heavy Body* [in *Mechanicks*] is a Line drawn through its Centre of Gravity, and according to which it tends downwards.

LINE *of Direction of Motion of any Body*, is that according to which it moves, or which directs and determines its Motion.

LINEAR *Numbers* [in *Arithmetick*] are such as have Relation to Length, as *v. gr.* such as represent one Side of a plane Figure; and if the plane Figure be square, the linear Number is called a *Root*.

LINEAR *Problem* [in *Mathematicks*] is such an one as may be solved geometrically by the Intersection of two Right-lines; as to measure an inac-

cessible Height, by means of two unequal Sticks: This is also call'd a Simple Problem, and is capable but of one Solution.

LINTEL [in *Architecture*] the Piece of the Timber that lies horizontally over Door Posts and Window Jambs, as well to bear the Thickness of the Wall over it, as to bind the Sides of the Walls together.

The Price.] Carpenters commonly put in these by the Foot running Measure, as *6 d. per* Foot, if Oak; and 4 *d.* if Fir, for Timber and workmanship.

LIST [in *Architecture*] is a little square Moulding, serving to crown or accompany a larger; or on occasion to separate the Flutings of a Column. It is sometimes called *Listella* and *Fillet*, and sometimes a *Square*.

LISTEL [in *Architecture*] a small Band, or a kind of Rule in the Mouldings; also the Space betwixt the Channellings of Pillars.

LOBBY. See *Antichamber*.

LOCAL PROBLEM [in *Mathematicks*] is such an one as is capable of an infinite Number of different Solutions; so that the Point which is to resolve the Problem, may be indifferently taken within a certain Extent. As suppose any where in such a Line, within such a plain Figure, &c. which is called *Geometrical Locus*, and the Problem is said to be a local or indeterminable one; and this local Problem may be either, *Simple*, when the Point sought is in a Right; *Plane*, when the Point sought is in the Circumference of a Circle; *Solid*, when the Point required is in the Circumference of a Conic Section; or lastly, *Sursolid*, when the Point is in the Perimeter of a Line of the higher Kind or second Gender, as Geometers call it.

LOCKS *for Doors* are of various Kinds; as for outer Doors, called Stock-locks; for Chamber-doors, call'd Spring-locks, &c. also the several Inventions in Locks, *i. e.* in contriving and making their Wards and Guards, are almost innumerable.

And as their Kinds are various, so are their Prices. I shall at present only mention some of the Chief, as

Stock Locks plain, from 10 *d.* to 14 *d. per* Piece, or more.

S Bitted Stock Locks, with a Pipe, 18 *d. per* Piece.

S Bitted and *warded Stock Locks* very strong, 7 *s.*

Brass Locks, from 5 *s.* 6 *d.* to 9 *s.*

Brass-knobbed Locks in iron Cases, 3 *s.*

Double Spring-Locks, 1 *s.*

Closet-door Locks, 1 *s.* 4 *d.*

Pad or Secret Locks, with Slits, instead of Pipes, 1 *s.*

Plate Stock Locks, 3 *s.* 8 *d.* Some ditto for half that Price.

Plate Stock Locks in Shuts 4 *s.* 6 *d.*

Brass-knobbed Locks in Shuts 6 *s.* 6 *d.*

Iron rimmed Locks, very large 10 *s.*

Mr. *Chamberlain* in his *Present State of Britain*, tells us that there are some Locks made

f Iron and Brass of 50, nay oo *l. per* Lock.

LOAM, a Sort of reddish arth, used in Buildings (when mpered with Mud, Gelly, raw, and Water) for plaiste-ng Walls in ordinary Houses.

LOGARITHMS, are Num-rs in arithmetical Progression, fitted to the natural Num-rs, that if any two natural umbers are multiply'd and vided by one another, the Lo-rithms of these natural Num-rs, that is, of those answer-g them, be added to, or sub-acted from each other, the Sum Remainder will be the Lo-rithm of the Product, or the uotient of those two natural umbers.

LONGIMETRY, the Art of easuring Lengths or Distances; of taking the Distances of ees, Steeples or Towers, &c. her one or many together.

LOGISTICAL *Arithmetick* s formerly the Arithmetick Sexagesimal Fractions.

LUNES } [in *Geometry*]
LUNULÆ } are Spaces con-ned under a Quadrant of a rcle and a Semi-Circle; being lled thus, because they repre-t the Figure of the Moon, en less then half full.

LUTHERN, or *Dormer*, a d of Window over the Cor-e, in the Roof of a Building; nding perpendicularly over Naked of a Wall; and serv-to illumine the upper ry.

The *French* Architects dis-uish these into various Kinds, rding to their various ms; as *square*, *semi-circular*, *Bulls Eyes*, *flat Arches Flemish Lutherns*, &c.

M.

MACHINE [in *Mechanicks*] an Engine; is whatsoever has Force sufficient, either to raise or stop the Motion of a Body; or it may be defined any thing that serves to augment or regulate moving Powers; or it is any Body destin'd to produce Motion, so as to save either Time or Force.

These Machines are either *simple*, or *compound*.

Simple Machines are commonly reckoned to be six in Number, *viz.* the *Ballance*, *Lever*, *Pully*, *Wheel*, *Wedge*, and *Screw*. To these might be added inclin'd Planes; since 'tis certain that the heaviest Bodies may be lifted up by the Means thereof, which otherwise could scarce be moved.

Compound Machines, or Engines, are innumerable, in regard that they may be made out of the *Simple*, after almost infinite manners: And yet the Ancients seem to have outdone the Moderns in this respect; their Machines of Architecture, &c. being describ'd as vastly superior to ours.

A Machine for Building, is an Assemblage of Pieces of Wood, so disposed as that by means of Ropes and Pullies a small Number of Men may raise vast Loads or Weights, and lay them in their Places; as Cranes, &c.

'Tis hard to conceive what

Machines the Ancients must have used to raise these immense Stones found in some of the antique Buildings.

Hydraulick, or *Water* MACHINE, is either used to signify a *Simple Machine*, serving to conduct or raise Water; as a Sluice, Pump, *&c.* or several of these acting together, to produce some extraordinary Effect; as the Machine of *Marli* in *France*; the *Primum Mobile* or first Mover of which is an Arm of the River *Seine*, which by its Stream turns several large Wheels, which work the Handles, and these with Pistons raise the Waters up into the Pumps; and with other Pistons force it up in Pipes against the Ascent of an Hill to a Reservoir in a Stone Tower, 62 Fathoms higher than the River, sufficient to supply *Versailles* with a constant Stream, 200 Inches in Diameter.

MAGIC SQUARES, the several Numbers that compose any Square (as suppose 1, 2, 3, 4, 5, *&c.* to 25 inclusive, which compose the Square Number 25.) being dispos'd after each other in a square Figure of 25 Cells, each in its Cell. If then you change the Order of these Numbers, and dispose 'em in the Cells in such manner, as that the five Numbers which fill any horizontal Rank of Cells, being added together, shall make the same Sum with the five Numbers in any other Rank of Cells, whether horizontal or vertical; and even the same Number with the 5 in each of the two Diagonal Ranks; this Disposition of Numbers is called a *Magic Square*, in opposition to the former, which is called a *Natural Square*.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

16	14	8	2	25
3	22	20	11	9
15	16	4	23	17
24	18	12	10	1
7	5	21	19	13

Or a Magick Square is when Numbers in arithmetical Proportion are disposed into such Parallel and equal Ranks, as that the Sums of each Row, as well diagonally as laterally shall be equal: Thus,

These nine Numbers, 2, 3, 4, 5, 6, 7, 8, 9, and 10, being disposed into this square Form they do every way directly and diagonally make the same Sum.

5	10	3
4	6	8
9	2	7

MAGNETISM, is the *magnetical Attraction*, or the Virtue and Power that the Magnet or Loadstone has of drawing Iron to it.

MAGNITUDE, is the same as Bigness or Greatness. It is any thing that has Parts external, to Parts, connected together by some common Term; *i. e.* any thing locally extended or continued; or that has several Dimensions.

The Origin of all Magnitude is a Point, which though void of Parts it self, yet its Flux forms a Line; the Flux of that a Surface, and of that, a Body.

Literal MAGNITUDE, is a Magnitude expressed by Letters.

Numerical MAGNITUDE, is a Magnitude expressed by Numbers.

A Broken MAGNITUDE, is a Fraction.

A Complex MAGNITUDE, is that form'd by Multiplication.

An incommensurable MAGNITUDE, is a Magnitude that has no Proportion to Unity.

MALLEABLE, something hard and ductile, and that may be beaten, forged and extended under the Hammer.

All Metals are malleable, exceptingQuicksilver; but Gold in the greatest Degree of all.

MALLET, a kind of large Hammer, made of Wood, much used by Artificers who work with the Chissel; as Sculptors, Masons, and Stone-cutters, whose Mallet is commonly round; Carpenters, Joiners, &c. who use a square one.

MALTHA, a kind of Cement, anciently in great use, composed of Pitch, Wax, Plaister, and Grease.

Besides this, the *Romans* had another kind of *Maltha*, with which they plaistered and whitened the Inside of their Aqueducts. This was a very fine Cement, consisting of Lime slak'd in Wine, incorporated with melted Pitch and fresh Figs.

The *Natural* MALTHA is a kind of Bitumen with which the *Asiaticks* plaister their Walls.

MANTLE [in *Architecture*] is the lower Part of the Chimney, or that Part laid across the Jambs, and which sustains the Compartiment of the Chimney Piece.

MARBLE, is a kind of Stone, extremely hard, firm, and solid, dug out of Pits or Quarries: It takes a beautiful Polish, cuts very hardly, and is much used in Ornaments of fine Buildings; as Columns, Altars, Statues, &c.

There is an infinite Number of different kinds of Marble, usually denominated, either from their Colour, the Country where produced, or their Effects: Some are of one simple Colour; as *white*, or *black*; others streak'd or variegated with Stains, Clouds, Waves, &c.

All *Marbles* are opake, except the white, which when cut into thin Slices, becomes transparent.

Marbles are also different in Weight and Hardness, and are to be considered with regard to their *Colour*, their *Country*, their *Grain*, and their *Defects*.

African Marble, is either of

a reddiſh Brown, ſtreak'd with Veins of *white*; or of a Carnation, with Veins of *green*.

Engliſh White Marble is vein'd with *Red*.

Marble of *Brabanzon* in *Hamault*, is black-vein'd with *White*.

Marble of *Auvergne* in *France* is of a pale *red*, mingled with *violet*, *green* and *yellow*.

Brocatelle Marble, is mingled with little Shades of *Iſabella*, *yellow*, *pale* and *gray*. This comes from *Tortoſa* in *Spain*, where it is dug out of an ancient Quarry.

There is alſo another ſort of *Brocatelle*, which is digged up near *Adrianople*.

Marble of *Champagne* reſembles the *Brocatelle*, being mix'd with *Blue*, in round Stains, like the Eyes of Partridges.

Marble of *Breſſe* in *Italy*, is yellow, with Spots of white.

Marble of *Carrara*, on the Coaſts of *Genoa*, is very white, and the fitteſt of all others for Works of Sculpture.

Cipollini or *Cipollin Marble*, is of a *Sea green* Colour, mix'd with large Waves or Clouds of *white*, or pale *green*.

Scamozzi thinks this is the ſame that the Ancients called *Auguſtum* and *Tiberium Marmor*, becauſe firſt found in *Egypt*, in the Times of *Auguſtus* and *Tiberius*.

Lumachello Marble, is ſo call'd becauſe mingled with Spots *grey*, *black*, and *white*, wreathed ſomewhat like Periwinkle Shells. This is ancient, and its Quarry is loſt.

Marble of *Margoſſe* in the *Milaneſe*, has a white Ground with *browniſh* Veins, reſembling the Colour of Iron ruſt. This is very common, and extremely hard.

Marble of *Dinan* near *Liege*, is of a pure black, very beautiful, and very common.

Marble of *Guachenet*, near *Dinan*, is of a reddiſh *brown*, with white Spots and Veins.

Marble of *Namure* is black, like that of *Dinan*, but leſs beautiful, as inclining a little to the *blue*, and traverſed with little Streaks of *grey*. This is very common, and is frequently uſed in Paving.

Marble of *Thou*, near *Namure* in *Liege*, is of a pure *black*, ſoft and eaſy to work, and receives a more beautiful Poliſh than thoſe of *Namure* and *Dinan*.

Marble of *Languedoc*, is of a vivid *red*, with large *white* Veins or Stains, and is very common. There is ſome whoſe *White* borders pretty much on the *blue*, and is leſs valued.

Marble of *Lavee* in *Maine*, has a black Ground, with little narrow Veins of *white*. There is another ſort of it *red*, with Veins of a dirty *white*.

Marble of *Ratrice* in *Hamault*, is of a dirty *red*, mix'd with *blue* and *white* Clouds and Veins. This is pretty common, but different in Beauty.

Marble of *Savoy* is of a deep *red*, mix'd with other Colours; each Piece of which ſeems cemented on to the reſt.

Parian Marble is antique, and much celebrated in Authors.

It

It is of a beautiful *white*: The greatest Part of the *Grecian* Statues were made of it. *Varro* calls it *Lychnites*, because the Workmen dug it out of the Quarry by Lamp light.

Marble of *Sicily*, is of a brownish *red*, stain'd with oblong Squares of *white* and *Isabella*, like strip'd *Taffetas*. The antient has very vivid Colours, and the modern comes pretty near it.

Marble of *Porta Santa*, at Rome called *Serna*, is mingled with large Clouds and Veins of *red*, *yellow*, and *grey*.

Marble of *Signan* in the *Pyreneans*, is ordinarily of a *greenish* brown, with red Stains, though this is somewhat various in its Colour.

Marble Portor has a *black* Ground, with Clouds and Veins of *yellow*. It is dug out of the Foot of the *Alps*, near *Carrara*.

Black Attic Marble, is of a pure *black*, without Stains, and softer than the modern black. There was some of it brought from *Greece*, called *Marmor Luculleum*; but this was not so much valued as that which the *Egyptians* brought from *Ethiopia*, approaching to an iron Colour, and call'd *Basaltes*, or Touch-stone, because it serv'd them for the Trial of Metals.

Marble Bigio Nero, is antique.

Antient Black and *White Marble*, is now very rare, the Quarries of it being intirely lost. It is divided between a pure *white*, and a bright *black*, in Plates.

White-vein'd Marble, has large Veins with *grey*.

White Marble, dug out of the *Pyrenæans*, on the Side of *Bayonne*, is inferior to that of *Carrara*, its Grains being larger, and shining like a kind of Salt. It is something like the antient white *Greek* Marble, whereof their Statues were made, but not so hard and beautiful.

Marble Fior di Persica, comes from *Italy*, and consists of *red* and *white* Stains, somewhat *yellowish*.

White and Black Marble, has a pure *black* Ground, with some very white Veins.

Blue Tunquin Marble is mix'd with a dirty sort of *white*, and comes from the Coast of *Genoa*.

Yellow Marble is a kind of *Isabella* yellow without Veins; it is antique, and now very rare.

The *Modern Green Marble*, improperly call'd *Egyptian* Marble, is brought from *Carrara*, on the Coast of *Genoa*: It is a deep *green*, spotted with *grey*.

Green Marble Antique, is a Mixture of *Grass green* and *black*, in Clouds of unequal Forms and Sizes, and is very rare, the Quarries being lost.

Marble Occhio di Pavone, or Peacock's Eye, is mingled with *red*, *white*, and *blueish* Clouds, somewhat resembling the Eyes at the end of a Peacock's Tail.

Marble denominated from its Defects.

Rigid MARBLE, is that which being too hard, is wrought with

Difficulty, and is apt to ſplinter, as the *black* Marble of *Namure*.

Thready Marble, is full of Threads or Filaments.

Brittle Marble, is what crumbles under the Inſtrument; as the *White Greek Marble*, and that of the *Pyreneans*, &c.

Terras Marble, is that which has ſoft Places in it, which muſt be filled up with Cement; as that of *Languedoc*.

There are two Defects frequent in *Marbles*, which make them the more difficult to be cut and poliſhed: The one is what Workmen ſometimes call *Nails*, which anſwers to the Knots in Wood: The other, call'd *Emeril*, is a Mixture of Copper, or other Metal, makeing *black* Stains in the Marble. The *Emerils* are only common to white Marbles; but the Knots to all.

Under the Genus of Marble is comprehended *Porphyry*, which is the hardeſt, and which was antiently brought from *Numidia* in *Africa*. The moſt beautiful is that whoſe *red* is the moſt vivid, and the Stains the whiteſt and the ſmalleſt. See *Porphyry*.

The *Serpentine* Porphyry, which is a *greeniſh brown*, ſo called, becauſe figured with little Stains. It is form'd of a great Number of Grains of Sand condenſed: It is of various Kinds, as *Egyptian*, *Italian*, *Violet*, and *Green*. See *Serpentine*.

Jaſper, of which there are various Kinds; the *Antient*, the *Florid*, the *Black*, the *White*, &c.

Alabaster, of which there are various Kinds, both white and variegated.

They are all ſoft, when taken out of the Quarry, but harden in the Air.

Uſes.] The principal Uſes of Marble in Architecture is for Chimney-pieces, Chimney Foot-paces, Window-ſtools, Pavements, &c.

Pliny and other Authors tell us that the Antients uſed to face their Houſes all over with thin Plates of Marble.

Of poliſhing Marble.] Some lay three or four Blocks in a Row; and with another, fix'd to a broad Beetle, and a Handle fixed at oblique Angles, with Sand and Water between, work the upper Stone backwards and forwards on the lower ones, till the Strokes of the Ax are worn off; after which they poliſh them with Ivory and Putty.

Sometimes to poliſh Tomb Stones, they block up the Stones to be poliſh'd, ſo as to lie horizontal about $2\frac{1}{2}$ Foot high above the Ground, and being laid very level, they work the upper Surface very ſmooth and even with a Tool for that Purpoſe.

This Tool is a Piece of whole Deal, about 18 or 20 Inches long, and 12 Inches broad, and croſs the Grain of the Wood on the upper Side are nail'd 2 Ledges on, at each End; and on theſe Ledges is nail'd a Staff or Handle, about 8 or 9 Foot long (enough to reach the Length of the Tomb-Stone) alſo at each End of the under Side

[Si]de is nail'd a Ledge, and [be]tween those Edges is wedg'd in (with wooden Wedges) a Hearth Stone of Marble, unpo[li]sh'd and very rough.

They fling Water and Sand upon the Tomb-Stone, and work it (by drawing the Hearth Stone to and fro) till the Hearth Stone becomes pretty smooth; then they take that out, and put in another rough Hearth Stone; and this they continue to do till they have wrought the Tomb-Stone pretty even and smooth.

But while the Tomb-Stone and Hearth Stones are rough, they lay a considerable weight (as a Stone or the like) upon the upper Side of the Tool, to keep it down hard on the Tomb-Stone; but when the Tomb-Stone is pretty smooth, they make it yet smoother, by putting into the Tool, one after another, several of those Hearth Stones already begun to be polish'd, and this they continue to do, till they have brought both them and the Tomb-Stone to a more smooth polish. Upon these they use no weight on the back of the Tool, but they use Water and Sand as before; and if they have no Marble Hearth Stones to polish, they put a Purbeck Stone into the Tool.

The Price of Chimney Pieces] of black fleak'd Marble, or of Rance or Liver colour'd Marble, is worth, of an ordinary Size, 12 or 14 *l.* a Piece.

Window Stools of black or white fleak'd Marble, are worth about 2*s.* 6*d. per* Foot.

Pavements of black or white Marble is worth about 2 *s. per* Foot.

English white Marble vein'd with *Red*, &c. is sold for about 2*s.* 6*d. per* Foot in Squares for Pavements, and Slabs of the same Sort of Marble (long enough for Chimney Foot paces) for 5*s. per* Foot.

Egyptian Marble vein'd with Variety of Greens in Slabs, 8*s. per* Foot.

Italian white Marble; for Chimney Foot Paces in Squares, for about 2*s.* 6*d. per* Foot; in Slabs, for 5*s. per* Foot, and black Marble is something cheaper.

Of Staining Marble.] Father *Kircher* shews the Manner of applying Colours on Marble, so as to make them penetrate its whole Substance, insomuch that if the Marble be slit into several parallel Tables or Planks, the same Image will be found on each, that was painted on the first.

Spots of Oil penetrate white Marble, so that they cannot be taken out.

The *Stuck* whereof they make Statutes, Busts, Basso Relievo's, and other Ornaments of Architecture, is only Marble pulveriz'd, mix'd in a certain Proportion with Plaister; the whole well sified, work'd up with Water, and us'd like common Plaister.

There is also a Sort of artificial Marble made of *Gypsum*, or a transparent Stone resembling Marble, which becomes very hard, receives a tolerable polish, and may deceive the Eye.

There

There is also a Sort of Marble form'd by corrosive Tinctures, which penetrating into white Marble to the Depth of a Line, imitates the various Colours of other Marbles.

Polish'd Marble is that which having been well rubb'd with Free-Stone, and afterwards with Pumice Stone, is at last polish'd with *Emery*, if the Marble be of several Colours; and if white, with Tin.

In *Italy* they polish with a Piece of Lead and Emery.

MARBLE COLOUR [in *Painting*.] That which is ordinary on new Stuff, is about 1 *s. per* Yard, and an old Colour about 9*d. per* Yard for Colour and Work.

MARQUETRY or *Inlaid Work*, is a Work compos'd of several fine hard Pieces of Wood of different Colours, fastened in thin Slices on a Ground, and sometimes inrich'd with other Matters, as Tortoise Shell, Ivory, Tin and Brass.

There is also another Kind of Marquetry made of Glasses of various Colours, instead of Wood; and also a third compos'd of nothing but precious Stones and the richest Marbles; but these last are rather call'd *Mosaic* Work.

The Art of Inlaying is very antient, and is suppos'd to have passed from *Asia* to *Europe*, as one of the Spoils brought from the Eastern Conquests by the *Romans* into *Italy*. It was indeed at that Time but a simple Thing, nor did it arrive at any tolerable Perfection before the fifteenth Century in *Italy*, nor did arrive at its Height ti the 17th Century among th *French*.

The finest Works of th Kind were only black and whit which we now call *Moresco's*, ti *John* of *Verona* Cotempora with *Raphael*; but that Rel gious who had a Genius fo Painting, stain'd his Woods wit Dyes or boil'd Oils, which pe netrated them.

But he went no farther tha the Representations of Build ings and Perspectives, whic require not any great Varie of Colours.

Those who came after him not only improved on the In vention of dying the Woods by a Secret they discovered o burning without consumin them, which serv'd exceeding ly well for Shadows; but ha also the Advantage of a Num ber of fine new Woods, of na turally bright Colours, by th Discovery of *America*.

With those Assistances th Art is now capable of imitatin any Thing; whence it is b some call'd the *Art of Paintin in Wood*.

The Ground on which th Pieces are to be arrang'd and glued, is usually of well dry'd Oak or Fir, and is compos'd of several Pieces glued together to prevent its warping.

The Wood to be us'd in Marquetry, is reduc'd into Leaves of the Thickness of a Line, *i. e.* the twelfth Part of an Inch is either stain'd with some Colour, or made black for Shadow; which some perform by putting it into Sand

ex-

treamly heated over the re; others by steeping it in ne Water, and Sublimate; l others in Oil of Sulphur.

Being thus colour'd, the Con-rs of the Pieces are form'd, ording to the Parts of the sign they are to represent.

This last is the most difficult rt of Marquetry, and that ich requires the most Pa-nce and Attention.

The two chief Instruments d in this Work, are the Saw l the Vice; the latter to ld the Matters to be form'd, l the other to take off from Extremes, as Occasion re-ires.

The Vice is of Wood, hav-g one of its Chaps fix'd, the her moveable, and is open'd l shut by the Foot, by Means a Cord fasten'd to a Treddle.

The Leaves to be form'd or there are frequently 3 or or more, of the same Kind, rm'd together) are after they ve been glued on the outer-oft Part of the Design, whose ofile they are to follow, put ithin the Chaps of the Vice; en the Workman pressing the reddle, and thus holding fast e Piece with his Saw, runs er all the Out-Lines of the esign.

By thus joining or forming or 4 Pieces together, not only ime is sav'd, but also the atter is the better enabled to stain the Effort of the Saw, hich how delicate soever it ay be, and how slightly soe-r the Workmen may conduct except this Precaution were ken, would be apt to raise Splinters, and ruin the Beauty of the Work.

When the Marquetry is to consist of one single Kind of Wood, or of Tortoise Shell on a Copper or Tin Ground, or *Vice versa*, they only form 2 Leaves, one on another, *i. e.* a Leaf of Metal, and a Leaf of Wood or Shell: This is call'd sawing in Counterparts; for by filling the Vacuities of one of the Leaves, by the Pieces coming out of the other, the Metal may serve as a Ground to the Wood, and the Wood to the Metal.

All the Pieces having been thus form'd by the Saw, and mark'd in Order to their being known again, and the Shadow given in the Manner before mentioned, each is vanneer'd or fasten'd in its Place on the common Ground, with the best *English* Glue.

This being done, the whole is set in a Press to dry, and planed over and polish'd with the Skin of the *Sea-Dog*, wax and shave grave, as in simple vaneering,

But withal with this Difference, that in Marquetry, the fine Branches, and several of the more delicate Parts of the Figures, are touch'd up and finish'd with a Graver.

Cabinet Makers, Joiners, &c. work in Marquetry; Stone-Cutters and Enamellers, deal in *Mosaic*.

MASON is a Person employed under the Direction of an Architect, in the raising of a Stone Building.

The chief Business of a Ma-

son

ſon is to make the Mortar, raiſe the Walls from the Foundation to the Top, with the neceſſary Retreats and Perpendiculars to form the Vaults, and employ the Stones, as deliver'd to him.

When the Stones are large, the Buſineſs of hewing or cutting them, belongs to the Stone-Cutters, though theſe are frequently confounded with Maſons; the Ornaments of Sculpture, are perform'd by Carvers in Stone, or Sculptors.

The Tools or Implements principally us'd by them, are, the Square, Level, Plumb-Line, Revel, Compaſs, Hammer, Chiſſel, Mallet, Saw, Trowel, &c. Beſides the common Inſtruments us'd in the Hand, they have likewiſe Machines for raiſing of great Burdens, the conducting of large Stones, *&c.*

MASONRY is a Branch of *Architecture*, conſiſting, as it is defin'd by ſome, in the Art of hewing or ſquaring of Stones, and cutting them level and perpendicular for the Uſes of *Building*: tho' in a more limited Senſe of the Word, *Maſonry* is the Art of aſſembling and joining Stones together with Mortar.

Whence there ariſe as many different Kinds of Maſonry, as there are different Forms and Manners of laying or joining Stones.

Vitruvius mentions 7 Kinds of *Maſonry* among the Ancients, 3 of hewn Stone, *viz.* That in Form of a *Net*; that in binding, and that call'd the *Greek Maſonry*; and 3 of unhewn Stones, *viz.* that of an *equal Courſe*, that of an *unequal Courſe*; and that fill'd up in the middle; the ſeventh was a Compoſition of all the Reſt,

MASONS Work is ſometimes meaſured by the ſuperficial Foot, and ſometimes by the ſolid Foot; and in ſome Places Walling is meaſured by the Rood, which is 21 Feet in Length, and 3 in Height, which makes 63 ſquare Feet.

Example 1. If a Wall be 97 Feet 5 Inches in Length, and 18 Feet 3 Inches in Height, and 2 Feet 3 Inches thick, how many ſolid Feet are contain'd in that Wall?

F.		I.				
97		5				
18		3				
776						
97						
24	:	4	:	3		
6	:	0	:	0		
1	:	6	:	0		
1777	:	10	:	3		
2	:		:	3		
3555	:	8	:	6		
444	:	5	:	6	:	9
4000	:	2	:	0	:	9

97.417
18.25
487085
194834
779336
97417
1777.86025
2.25
888930125
355572050
355572050
4000.1855625

The Length, Height and Thickneſs being multiply'd together, the laſt Product is 4000 Feet 2 Inches, the ſolid Foot contain'd in the Wall.

By Scale and Compaſſes.

Extend the Compaſſes from 1 to 1.825, and that Extent will reach from 97.417 to 1777.86; then extend them from 1 to 1777.86, and that Extent will reach from 2.25, to 4000.18. the ſolid Content.

Example 2. If a Wall be 107 Feet, 9 Inches long, and 20 Feet 6 Inches high, how many ſuperficial Feet does it contain?

F.		I.		
107	:	9		
20	:	6		
2155	:	0		
53	:	10	:	6
2208	:	10	:	6

107.75
20.5
53875
12550
2208.875

Facit 2208 Feet, 10 Inches.

By Scale and Compaſs.

Extend the Compaſſes from 1, to 107.75, and that Extent will reach from 20.5 to 2208.875. the ſuperficial Feet.

Example 3. If a Wall be 112 Feet 3 Inches in Length, and 16 Feet 6 Inches in Height, how many Roods does it contain.

F.		I.		
112	:	3		
16	:	6		
676	:	0		
112				
56	:	1	:	6
1852	:	1	:	6

112
16.5
56125
67350
11225
63) 1852.125 (29
592
25

Facit 29 Roods, 25 Feet.

By Scale and Compaſſes.

Extend the Compaſſes from 63 to 16.5, and that Extent will reach 112.25, to 29.460 Roods the Content.

Net MASONRY, call'd *Reticulation*, from its Reſemblance to the Maſhes of a *Net*, conſiſts of Stones ſquar'd in their Courſes, and ſo diſpos'd, as that their Joints go obliquely, and the Diagonals are the one perpendicular, and the other level: This is the moſt agreeable Maſonry to the Eye, but it is apt to crack.

Bourd MASONRY, is that in which the Stones were plac'd one over another like Tiles; the Joints of their Beds being level,

level, and the Mounters perpendicular: So that the Joint that mounts and separates two Stones, fall directly over the middle of the Stone below. This is less beautiful than the *Net* Work, but is more solid and durable.

Greek MASONRY (according to *Vitruvius*) is that, where after 2 Stones have been laid, each of which makes a Course, another is laid at the End, which makes 2 Courses, the same Order being observ'd throughout the Building, this may be called *Double Building*, in Regard that the binding is not only of Stones of the same Course with one another; but likewise of one Course with another Course

MASONRY *by equal Courses*; this was by the Ancients call'd *Isodomum*, and differs not from bound *Masonry*; but only in this, that its Stones are not hewn.

MASONRY *by unequal Courses*, which the Ancients call'd *Pseudisodomum*, was also made with unhewn Stones, and laid in *Bound Work*; but then they are not of the same Thickness, nor is there any Equality observ'd, excepting in the several Courses; the Courses themselves being unequal to each other.

MASONRY *fill'd up in the middle*, which the Ancients call'd *Emplecton*, is likewise made of unhewn Stone, and by Courses; but the Stones are only set in Order as to the Courses; the Middle being fill'd up with Stones thrown in at Random among the Mortar.

Compound MASONRY, is *Vitruvius*'s proposing; and so call'd, as being form'd of a[ll] the Rest. In this the Cours[es] are of hewn Stone, and th[e] middle Place left void, fill'd u[p] with Mortar and Pebbles throw[n] in together. After which, th[e] Stones of one Course, are boun[d] to those of another Course, wi[th] Cramp-Irons, fasten'd wi[th] melted Lead.

All the Kinds of MASONR[Y] now in Use, may be reduc[']d to these 5, *viz. Bound Mason[ry]* that of *Brick-Work*, where th[e] Bodies and Projectures of th[e] Stones inclose square Spac[es] or Pannels, &c. set with Bricks That *de Moilon*, or small Work where the Courses are equal well squared, and their Edg[es] or Beds rusticated; that wher[e] the Courses are unequal; an[d] that fill'd up in the middl[e] with little Stones and Mortar.

MASQUE [in *Architecture*] is us'd of certain Piece[s] of Sculpture, representing som[e] hideous Form, Grotesque o[r] Satyrs Faces, &c. us'd to fi[ll] up and adorn some vacant Places, as in Freezes, the Pannel[s] of Doors, Keys of Arches, &[c.] but especially in Grotto's.

MASTICOTE is a good light yellow, for most Use[s] especially in making Greens of which there may be severa[l] Sorts made out of this Colour by mixing it with Blues. Thi[s] Colour grinds very fine, an[d] bears a good Body.

MATHEMATICKS } origi-
MATHESIS } nally

signify'd any Discipline or Learning; but now 'tis properly tha[t]

Science

ience which teaches or contemplates, whatever is capable being numbred or meaſured, it is computable or meaſuble.

And the Part of Mathemaks, which relates to Number y, is call'd *Arithmetick*; t which relates to Meaſure general, whether Length, eadth, Motion, Force, *&c.* all'd *Geometry.*

Mathematicks may be diſtiniſhed into *Simple* and *Mix'd.*

1. *Pure, Simple,* or *Abſtract* which conſiders abſtracted antity, without any Relan to Matter or ſenſible Obts; or

Mixt Mathematicks, which interwoven every where h Phyſical Conſiderations; it conſiders Quantity as ſubing in material Beings.

Mathematicks are alſo diled into *Speculative* and *Practical.*

1. *Speculative,* which profes only the ſimple Knowge of the Thing propoſed, the bare Contemplation of uth, or Falſhood. And

Practical, which teaches how demonſtrate ſome thing uſe, or to perform ſomething t ſhall be propoſed for the Benefit and Advantage of nkind.

MEAN or *middle Proportion*, between any two Nums or *Lines,* is that which h the ſame Proportion.

Thus 6 is a Mean Proporal between 4 and 9, becauſe 6 :: 6 : 9.

The Square of a Mean Proportional is equal to the Rectangle under the Extremes.

Two Mean Proportionals between two Extremes cannot be found by a ſtrait Line and a Circle; but it may very eaſily be done by the Conick Sections, *&c.*

MEASURE [in *Geometry*] any certain Quantity aſſumed as one or Unity, to which the Ratio of other Homogeneous or Similar Quantities is expreſſed.

MEASURE *of a Number* [in *Arithmetick*] is ſuch a Number as divides another without leaving any Fraction. Thus 9 is a Meaſure of 27.

MEASURE *of a Line,* is any right Line taken at Pleaſure.

MEASURE *of a Figure,* or *plain Surface,* is a Square or Side of any determinate Length. Among Geometricians 'tis uſually a *Perch,* called a *ſquare Perch,* divided into 10 ſquare Feet, and the ſquare Feet into ſquare Digits: Thence call'd *Square Meaſures.*

MEASURE *of a Solid,* is a Cube whoſe Sides are of any Length at Pleaſure.

MEASURE *of an Angle,* is an Arch deſcrib'd from the *Vertex* in any Place between its Legs.

MEASURE *of Velocity* [in *Mechanicks*] is the Space paſſed over by the moving Body in a given Time.

MEASURE *of the Maſs or Quantity of Matter* [in *Mechanicks*] is its Weight.

MEASURING [*Geometrically* defin'd] is the aſſuming any certain Quantity, and expreſſing the Proportion of other ſimilar

similar Quantities to the same: But *popularly* defin'd, Measuring is the using a certain known Measure, and determining thereby the precise Extent, Quantity or Capacity of any Thing.

MEASURING [in the General] makes the practical Part of *Geometry*, from the various Subjects wherein it is employ'd: It acquires various Names, and constitutes various Arts.

MEASURING *of Lines* or Quantities of one Dimension is called *Longimetry*; and when those Lines are not extended parallel to the Horizon, *Altimetry*; when the different Altitudes of the two Extremes of the Lines are alone regarded, it is called *Levelling*.

MEASURING *of Superficies* or *Quantities* of two Dimensions, is denominated variously according to its Subjects. When it is conversant about Lands, it is called *Surveying*; in other Cases, *simple Measuring*.

MEASURING *of Solids*, or Quantities of three Dimensions, is called *Stereometry*; when it is conversant about the Capacities of Vessels, or the Liquors they contain particularly, *Gauging*.

MECHANICKS, is the *Geometry* of Motion, being that Science which shews the Effect of Powers or moving Forces, so far as they are applied to Engines, and demonstrates the Laws of Motion.

MECHANIC *Powers*, are the five simple Machines, to which all others, how complex soever, are reducible, and of the Assemblage thereof they are all compounded.

MECHANICAL *Affections of Matter*, are such Properties of Matter as result from their Figure, Bulk, and Motion.

MECHANICAL *Solution of a Problem* [in *Mathematicks*] is either when the Thing is done by repeated Trials; or when the Lines made use of to solve it, are not truly Geometrical.

MEDIATE or *Intermediate*, is a Term of Relation to two Extremes, applied to a third, which is in the Middle.

MEMBRETTO [in *Architecture*] an *Italian* Term for a *Pilaster*, that bears up an Arch: These are often fluted, but not with more than seven or nine Channels. They are frequently used to adorn Door-Cases, Gallery Fronts, and Chimney Pieces, and to bear up the Cornices and Freezes of Wainscot.

MENSURABILITY, is an Aptitude in a Body whereby it may be applied or conformed to a certain Measure.

MENSURATION, or Measuring, is the Art or Act of finding the Superficial Area or solid Content of Surfaces or Bodies

METOCHE [in *Antient Architecture*] is a Term used by *Vitruvius* to signify the Space or Interval between the Dentils.

METOPE } [in *Architec-*
METOPA } *ture*] is the Interval or square Space between the Triglyphs of the Freeze of the *Doric*, which among the Antients us'd to adorn those Parts with carved Work or Painting, representing the Heads of Oxen, and other Utensils of the heathen Sacrifices.

A

As there is found some Difficulty in disposing the *Triglyphs* and *Metopes*, in that just Symmetry that the *Doric* Order requires, some Architects make it a Rule, never to use this Order, but in Temples.

METOPES. M. *le Clerc* says, the Beauty of them consists in their Regularity, that is, in their being perfect Squares: And yet, when they are really square, they appear to be less in Height than in Breadth; which is owing to the Projecture of the little Bandelet whereon they terminate underneath, which hides a small Part of their Height: For which Reason he makes the *Metopes* a Minute or two more in Height than in Breadth; being of Opinion they ought rather to appear square, without being so, than to be really so, without appearing so.

He also observes, that when the Triglyphs and Metopes follow each other regularly, the Columns must only stand one by one; exempting those of the inner Angles, which ought always to be accompanied with two others, one on each Side; from which the rest of the Columns may be placed at equal Distances from each other: And it is to be observ'd, that these two Columns, which accompany that of the Angle, are not less necessary on the account of the Solidity of the Building, than of the Regularity of the Intercolumniations.

Semi - METOPE, is a Space somewhat less than half a Metope in the Corner of the *Doric* Freeze. The Word Metope in the original *Greek* signifies the Distance between one Aperture or Hole and another; or between one Triglyph and another; the Triglyph being supposed to be Solives or Joists that fill the Apertures.

MEZZANINE, a Term us'd by some Architects, to signify an *Entresole*.

The Word is borrowed from the *Italians*, who call those little Windows which are less in Height than in Breadth, which serve to illuminate an Attic or an Entresole, *Mezzanine*.

MILLION [in *Arithmetick*] the Number of ten hundred thousand, or a thousand thousand.

MINUTE [in *Architecture*] is the 30th or 60th Part or Division of a Module; as a Module is usually the Diameter of the lower Part of a Column.

MITCHELS, are Purbeck Stones for paving, peck'd all of a Size, from 15 Inches square to two Foot, being squar'd and hew'd ready for Paving. They are said to be sold at 2 *s.* 10 *d.* *per* Foot.

MIXT *Number* [in *Arithmetick*] is that which is partly an Integer, and partly a Fraction; as $6\frac{3}{4}$.

MIXT *Figure* [in *Geometry*] is that which consists partly of right Lines, and partly of curved ones.

MODEL [in *Architecture*] is particularly used in Building for an artificial Pattern made in Wood, Stone, Plaister, or other Matter, with all its Parts and Proportions, in order for the better

better conducting and executing some great Work, and to give an Idea of the Effect it will have in large; or it may be defin'd a small Pattern of a House, &c. made by a small Scale; wherein an Inch, or half an Inch represents a Foot, for the more exactly carrying on the Design.

In all large Buildings it is much the surest way to make a *Model* on *Relievo*, and not to trust to a bare Design or Draught.

MODERN [in *Architecture*] is improperly applied to the present, or *Italian* Manner of building; as being according to the Rules of the *Antique*; nor is the Term more properly applied, when attributed to Architecture purely *Gothic*.

Modern Architecture, strictly speaking, is only applicable to that which partakes partly of the antique, retaining somewhat of its Delicacy and Solidity, and partly of the *Gothic*; whence it borrows Members and Ornaments without any Proportion or Judgment.

MODILLIONS [in *Architecture*] are Ornaments in the Cornish of the *Ionic*, *Corinthian*, and *Composite* Columns.

The *Modillions* are small Consoles or Brackets, under the Soffit or Bottom of the Drip of the Cornish, seeming to support the *Larmier*, tho' in Reality they are no more than Ornaments.

They ought always to be plac'd over the Middle of the Column. They are particularly affected in the *Corinthian* Order, where they are usually inrich'd with Sculpture.

The *Modillion* is usually i[n] the Form of an S inverted, and fitted to the Soffit of the Cor-nish.

The Proportion of *Modil-lions* ought to be so adjusted a[s] to produce a Regularity in th[e] Parts of the Soffits.

The *Inter-Modillions*, i. e. the Distances between them depend on the inner Columns which oblige the *Modillions* t[o] be made of a certain Length and Breadth, in order to make the Intervals perfect Squares which are always found to have better Effect than Parallelo-grams.

Also in adjusting the *Modil-lions*, Care is to be taken tha[t] they have such a Proportion, a[s] that when the Orders are plac'd over one another, there be th[e] same Number in the upper Or-der as in the lower, and tha[t] they fall perpendicular over on[e] another.

Modillions are also used un-der the Cornishes of Pediments tho' *Vitruvius* observes that the[y] were not allowed of in his Time because *Modillions* were intend-ed to represent the Ends o[f] Rafters. *Daviler* rather take[s] them for a kind of inverte[d] *Consoles* or *Corbels*.

The *Modillions* are also some-times called *Mutules*; tho' U[se] has introduced a little Diffe-rence between the Idea of [a] *Modillion* and a *Mutule*; th[e] *Mutule* being peculiar to th[e] *Doric* Order; and the *Modil-lions* to the higher Orders.

In the *Ionic* and *Composite* Or-ders, *Modillions* are more sim-ple, having seldom any Orna-

ments

nents, except ſometimes a ſin-gle Leaf underneath.

M. *Le Clerc* obſerves on the *Corinthian* Order, that it is uſual to have a Leaf that takes up their whole Breadth, and almoſt their whole Length too.

But he is of Opinion, that the *Modillions* would be more graceful, if this Leaf were leſs both in Length and Breadth.

For this Reaſon he incloſes it between two Liſts, wherein it ſeems, as it were, to be ſet, and out of which it never comes, but to form its Return againſt the little Wave of the *Modillions*, which it joins without hiding: From this Relation of the Leaf with the *Modillions*, the latter is render'd exceeding graceful.

The Leaf of the *Modillion* ought to be of the ſame Kind with thoſe which make the Ornament of the Capital; which is a Rule not to be diſregarded.

He likewiſe obſerves, that the meaſuring of the *Modillions* of the *Roman*, and the other Orders, are not barely concerted with a View to the juſt Proportion of thoſe Parts, but alſo to eſtabliſh a Regularity in the Parts of the Plafond or Soffit of the Cornice.

The Diſtance between one *Modillion* and another, depends on that between the Intercolumns; and that Diſtance obliges us to make the *Modillions* of a certain Height and Breadth; in Order to have the Spaces that ſeparate them in the Soffit perfectly ſquare.

Not only becauſe thoſe Squares are more regular than long Squares, but alſo becauſe they may be continued uniform through the projecting and re-entering Angles, which long Squares are incapable of; as may be obſerv'd in the Buildings, made according to the Rules of *Vignola*.

Further, in making the Diviſion of the Inter-Modillions, Care muſt be taken, that they have ſuch a Proportion, as that when the Orders are plac'd over one another, the *Modillions* of the lower Order be found in the ſame Number.

He alſo obſerves, as to the Intervals of the *Modillions* of the *Spaniſh* Order, that they are farther apart than in the *Roman*, but leſs than in the *Corinthian*, which is a Thing neceſſary, in Order to be able, on Occaſion, to place theſe Orders one over another.

For as any Order ought to be leſs high than that whereon it is plac'd; the *Corinthian* when plac'd over the *Spaniſh*, ſhould be leſs than the *Spaniſh*, as that when plac'd over the *Roman*, ſhould in like Manner be leſs than the *Roman*: So that the under Columns being bigger than the upper, the Bottom of the upper being bigger than the Top of the under, and yet their *Modillions* be found exactly over one another, which were Things impracticable, unleſs the *Modillions* were at the ſame Diſtance, proportional to the Orders.

Whence it may be obſerv'd, that it is not enough to compoſe beautiful Orders; but they muſt alſo be match'd and

adjusted to one another, if they are to go together, as 'tis frequently necessary they should do.

MODULE [in *Architecture*] is a certain Measure or Bigness taken at Pleasure, for regulating the Proportions of Columns, and the Symmetry or Distribution of the whole Building.

Architects generally chuse the Semi-Diameter of the Bottom of the Column for their *Module*, and this they subdivide into Parts or Minutes.

The *Module* of *Vignola*, which is a Semi-Diameter, is divided into 12 Parts in the *Tuscan* and *Doric*; and into 18, for the other Orders.

The *Module* of *Palladio*, *Scamozzi*, M. *Cambray*, *Desgodetz*, *Le Clerc*, &c. which is also equal to the Semi-Diameter, is divided into 30 Parts or Minutes in all the Orders.

The whole Height of the Column is divided by some into 20 Parts for the *Doric*, 22½ for the *Ionic*, 25 for the *Roman*, &c. and one of these Parts, is made a *Module*, to regulate the Rest of the Building by.

There are two Ways of determining the Measures or Proportions of Buildings.

The *First* is, by a fixt Standard Measure, which is usually the Diameter of the lower Part of the Column, call'd a *Module*, subdivided into 60 Parts, call'd Minutes.

In the *Second*, there are no Minutes, nor any certain or stated Division of the *Module*; but it is divided occasionally into as many Parts as are judg'd necessary.

Thus the Height of the *Attic* Base, which is half the *Module*, is divided into 3, to have the Height of the Plinth; or into 4 for that of the greater *Torus*, or into 6, for that of the lesser.

Both these Manners have been practised by the ancient as well as the modern Architects; but the Second, which was that chiefly us'd among the Ancients, is in the Opinion of M. *Perrault*, the most preferable.

As *Vitruvius* has lessen'd his *Module* in the *Doric* Order which is the Diameter of the lower Part of the other Orders and has reduc'd that great *Module* to a mean one, which is the Semi-Diameter, the *Module* is here reduc'd to the third Part for the same Reason, *viz.* to determine the several Measures without a Fraction.

For in the *Doric* Order besides that the Height of the the Base, as in the other Orders, is determin'd by one of these mean *Modules*; the same *Module* gives likewise the Heights of the *Capital*, *Architrave*, *Triglyphs*, and *Metopes*.

But our little *Module*, taken from the third of the Diameter of the lower Part of the Column, has Uses much more extensive; for by this, the Height of Pedestals, or Columns and Entablatures in all the Orders, are determined without a Fraction.

As then the great *Module*

Diam

iameter of the Column has
Minutes, and the mean *Mo-*
le or half the Diameter 30
inutes, our little *Module* has
.

MOMENT [in *Mechanicks*] the ſame with Impetus or the uantity of Motion in any oving Body; and ſometimes is us'd ſimply for the Motion ſelf. *Moment* is frequently efin'd by the *vis inſita*, or e Power by which moving odies continually change Place.

MOMENTS [in *Geometry*] e the generative Principles Magnitude; they have no etermin'd Magnitude of their wn, but are only inceptive ereof.

MONOPTERE [in the anent *Architecture*] a Kind of emple, round and without alls, having a Dome, ſuported with Columns.

MONUMENT [in *Archi-ture*] a Building deſtin'd to reſerve the Memory, &c. of e Perſon who rais'd it, or for hom it was rais'd. Such is Triumphal Arch, a Mauſoum, a Pyramid, &c.

The firſt Monuments that ere erected by the Ancients, ere the Stones which were id over Tombs, on which ere cut the Names and Acons of the Deceas'd.

Theſe Stones were diſtinuiſh'd by various Names, acording as their Figures were ifferent. The *Greeks* call'd oſe which were ſquare in eir Baſe, and were the ſame epth throughout their whole ength, *Steles*; from whence r Square Pilaſters or *Attic* Columns were deriv'd.

Thoſe which were round in their Baſe, and ended in a Point at Top, they call'd *Styles*, which gave Occaſion to the Invention of diminiſh'd Columns.

Thoſe which were ſquare at the Foot, and terminated in a Point at the Top, in the Manner of a Funeral Pile, they call'd *Pyramids*.

To thoſe whoſe Baſes were more in Length than in Breadth, and which roſe ſtill leſſening to a very great Height, reſembling the Figure of the Spits or *Obelisks*, or Inſtruments which the Ancients us'd in roaſting their Sacrifices, they called *Obelisks*.

MONOTRIGLYPH [in *Architecture*] a Term that ſignifies the Space of one Triglyph between two Pilaſters or two Columns.

MORISCO WORK } a Kind
MORESK WORK } of antic Work in Carving or Painting, done after the Manner of the Moors, conſiſting of ſeveral Groteſque Pieces and Compartments, promiſcuouſly intermingled, not containing any perfect Figure of a Man or other Animal, but a wild Reſemblance of Birds, Beaſts, Trees, &c.

MORTAR } [in *Architec-*
MORTER } *ture*] is a Preparation of Lime and Sand, mixt up with Water, ſerving as a Cement, and us'd by Maſons and Bricklayers in Building of Walls of Stone and Brick.

For Plaiſtering of Walls, they make their Mortar of

 Lime,

Lime, and Ox or Cow Hair, tempered well together with Mortar.

Of making common Mortar] As to the Proportion of Lime and Sand to be us'd in making common Mortar, there are different Opinions.

Vitruvius ſays, you may put three Parts of Dug (or Pit-Sand) to one Part of Lime; but if the Sand be taken out of a River, or out of the Sea, then two Parts of it, and one of Lime. He alſo adds, that if to the River or Sea Sand, you put one third Part of Powder of Tiles or Bricks, it will work the better.

But *Vitruvius*'s Proportion of Sand ſeems too much, tho' he ſhould mean of Lime before it is ſlak'd; for one Buſhel of Lime before 'tis ſlak'd, will make five Pecks, after 'tis ſlak'd.

About *London* (where for the moſt Part Lime is made of Chalk) they put about 36 Buſhels of Pit Sand to 25 Buſhels of Quick Lime, that is, about a Buſhel and a half of Sand to a Buſhel of Lime.

In ſome Places they put after the Proportion of three Pecks of Sand to one Buſhel of Lime; in other Places a Buſhel and half of Sand, to a Buſhel of Lime.

In Effect, the Proportion of Lime to Sand in making of Mortar, ought to be according to the goodneſs or badneſs of theſe Materials, and is therefore rather to be regulated by the Judgment of experienc'd Workmen in each particular Country, than by any ſtat[ed] Proportions of Materials.

As to the Method of maki[ng] of Mortar], Some Workme[n] are of Opinion 'tis the be[st] Way not to uſe Mortar as ſoo[n] as it is made; nor (in makin[g] it) to make the Lime run be[fore] it is mix'd with the San[d] (as ſome do) but rather t[o] throw the Sand on the Lim[e] while it is in the Stones, befor[e] it is run, and ſo to mix it to[gether], and then to wet it; b[y] which Means (they ſay) it wi[ll] be the ſtronger, and when [it] has lain a while before it [is] us'd, will not be ſo ſubject t[o] blow and bliſter.

Others adviſe to let Morta[r] (when made) lie in a Heap tw[o] or three Years before it is us'd, which they ſay, will render [it] the ſtronger and better; the[y] likewiſe ſay, the uſing of Mortar as ſoon as 'tis made, is th[e] Cauſe of ſo many inſufficien[t] Buildings.

Others adviſe, that in ſlaking of Lime, to wet it every where but a little (and not to over-wet it) and to cover every Laying or Bed of Lime (about the Quantity of a Buſhel) with Sand, as you ſlake it; that ſo the Steam or Spirit of the Lime may be kept in, and not fly away, but mix it ſelf with the Sand; which will render the Mortar conſiderably ſtronger, than if it were all ſlak'd at firſt, and the Sand thrown on altogether at laſt.

2. That all the Mortar ſhould be well beaten with a Beater, three or four times over, before it is us'd, by that Means to break

eak all the Knots of the Lime ll together; and they say, at the Air which the Beater rces into the Mortar at every roke, conduces very much the Strength of it.

3. That when you design to ild well, or use strong Mor- for Repairs, you beat the ortar well, and let it lie two three Days, and then beat it ll again, when it is to be 'd.

4. That Mortar be us'd as ft as may be in Summer ime; but pretty stiff or hard Winter.

As to mixing and blending Mortar, Mr. *Felibien* ob- rves, that the ancient Masons ere so very scrupulous herein, at the *Greeks* kept ten Men nstantly employ'd for a long pace of Time, to each Bason, hich rendred it of such pro- gious hardness, that *Vitru- us* tells us, the Pieces of Plai- r falling off from old Walls, rv'd to make Tables.

And Mr. *Felibien* tells us, s a Maxim among old Masons their Labourers, that they ould dilute it with the Sweat their Brow, *i. e.* labour it a ng Time, instead of drown- g it with Water, to have done e sooner.

Mr. *Worlidge* advises, that if u would have your Mortar rong, where you cannot have ur Choice of Lime, but can use your Sand and Water, t to use that Sand that full of Dust; for all dusty nd makes the Mortar weaker; d the rounder the Sand is, e stronger the Mortar will be, as is usually observ'd in Water drift Sand; that it makes bet- ter Mortar than Sand out of the Pit.

Therefore he advises, that if you have Occasion for ex- traordinary Mortar, to wash your Sand in a Tub, till the Water, after much stirring, comes off clear, and to mix that with new Lime, and the Mortar will be very strong and durable. And if the Water be foul, dirty, or muddy, the Mortar will be the weaker.

Wolfius observes, that the Sand should be dry and sharp, so as to prick the Hands when rubb'd; yet not earthy, so as to foul the Water it is wash'd in.

He also finds Fault with Ma- sons and Bricklayers, as com- mitting a great Error in letting their Lime slacken and cool before they make up their Mor- tar, and also in letting their Mor- tar cool and die before they use it; therefore he advises, that if you expect your Work to be well done, and to continue long, to work up the Lime quick, and but a little at a Time, that the Mortar may not lie long before it be us'd.

So that it appears, Men dif- fer in their Opinions in this Point; some affirming it to be best to work up the Mortar new, and others, not till it has lain a long Time.

A certain Author tells us, that an experienc'd Mason told him, that being at work at *Eridge-Place*, (at the Lord *Abergaveny*'s) at *Fant* in *Sussex*, they would have him make

use of Mortar that had been made four Years. But when he came to try it, he said it was good for Nothing, because it was so very hard, that there was no tempering it. Upon which, a certain Jesuite (who resided in the House, and had been a great Traveller) told him, that to his Knowledge at several Places beyond Sea, they always kept their Mortar 20 Years before they us'd it; but then this Mortar was kept in Cisterns for the Purpose, and always moist.

The Ancients had a Kind of Mortar so very hard and binding, that after so long a Duration, 'tis next to impossible to separate the Parts of some of their Buildings; tho' there are some who ascribe that excessive Strength to Time and Influences of certain Properties in the Air, which is found to harden some Bodies very surprisingly.

De Lore observes, that the best Mortar is that made of *Puzzuoli*; adding, that it penetrates black Flints, and turns them white.

The Lime us'd in the ancient Mortar is said to be burnt from the hardest Stones, and even the Fragments of Marble.

As for the scaling (or crimping) of Mortar out of the Joints of Stone and Brick-Walls, some are of Opinion it proceeds from the badness of the Sand or Lime, or both, as well as from the Season of Year when Work is done.

Besides the common Mortar us'd in laying Stones, Bricks, &c. there are several other Kinds, as

White Mortar, us'd in Plaistering the Walls and Ceilings, which are often first plaistered with Loam, and is made of Ox or Cow Hair, mix'd and temper'd with Lime and Water, without any Sand.

The common Allowance in making this Kind of Mortar is one Bushel of Hair to six Bushels of Lime; the Hair serves to keep the Mortar from cracking; binding it, and holding it fast together.

The MORTAR us'd in making Water Courses, Cisterns, &c. is very hard and durable, as may be seen at *Rome* at this Day. It is us'd not only in Building of Walls, but also in making of Cisterns to hold Water, and all manner of Water Works, and also in finishing or Plaistering of Fronts, to represent Stone Work.

There are two Kinds of it, the one is compounded with Lime and Hogs Grease, and mixt with the Juice of Figs; and the other is of the same Ingredients, but has liquid Pitch added to it, and is first wet or slak'd with Wine, and then pounded or beaten with Hogs Grease, and Juice of Figs.

That which has Pitch in it, is easily distinguish'd from the other by its Colour; and what is plaistered with this Kind of Mortar, is wash'd over with Linseed Oil.

Mortar for Furnaces, &c. is made with red Clay, wrought in Water, wherein Horse Dung and Chimney Soot has been steep'd, by which a Salt is communicated to the Water, bind-

inding the Clay, and making t fit to endure the Fire: This Clay ought not to be too fat, eſt it ſhould be ſubject to Chinks; nor too lean or ſandy, eſt it ſhould not bind enough.

Some Operators in Metal, ſe a Kind of Mortar to plaiſter ver the Inſide of their Veſſels n which they refine their Metals, to keep the Metal from unning out; and this Kind of Mortar is made with Quick-Lime and Ox-Blood; the Lime eing firſt beaten to powder, nd ſifted, and afterwards mixt vith the Blood, and beat with Beater.

The Glaſs-makers in *France* re ſaid to uſe a Sort of Mortar (for plaiſtering over the Inſides of their Furnaces) which s made of a Sort of Fuller's Earth, which is procur'd at *Beiere*, near *Forges*, which is he only Earth in *France* that as the Property of not melting in this exceſſive Heat; and lſo the Pots which hold the nelted Metal, are made of his Sort of Earth, and will aſt a long Time.

Mortar for Sun-Dials on Walls, may be made of Lime r Sand tempered with Linſeed Oil, and for Want of Linſeed Oil, may be made of ſcumm'd Milk; but Oil is better: This ſpread upon the Wall, vill harden to the hardneſs of Stone, and not decay in many Years, and will endure the Weather ſix times as long as he ordinary Plaiſter, made of Lime and Hair with Water.

A certain Author ſays he as known a very ſtrong and tough Mortar (for a Sun-Dial Plane) has been made after the following Manner.

There was taken five or ſix Gallons of Brook Sand, and dry'd on an Oaſt; and after that ſifted through a fine ſplinted Sieve, and then mix'd with it the ſame Quantity, or rather ſomething more of ſifted Lime, and a Gallon of Boreing (or Gun) Duſt ſifted alſo; theſe were all wetted and well tempered with ſix or ſeven Gallons of ſcumm'd Milk, and about two Quarts of Linſeed Oil.

This was laid on the Wall firſt, well wetted with Milk; but this prov'd very troubleſome to the Workmen to ſet it ſmooth; by Reaſon that it dry'd ſo very faſt; but by keeping it often ſprinkled with Milk, and ſmoothing it with the Trowel, it did at laſt ſet with a ſmooth and ſhining Surface.

But notwithſtanding all his Care (as it dry'd) it crack'd pretty much, which might probably proceed from the Want of Hair to it; it did alſo blow Bliſters, tho' the Lime was ſifted; which probably might have been prevented, if the Lime had been prepar'd as for *Freſco Painting*.

Extraordinary good Mortar for Floors, Walls, Ceilings, &c.

Temper Ox Blood and fine Clay together, then lay the ſame in any Floor, or plaiſter any Wall or Ceiling with it, and it will become a very ſtrong and binding Subſtance. This is ſaid by ſome to be much us'd in *Italy*.

In

In Buildings one Part of waste Soap Ashes mix'd with another of Lime and Sand, make a very durable Mortar.

This Mortar may be made, as it was by a certain eminent Soap Boiler, who built himself a very handsome House with it in the following Proportions; two Load of waste Soap Ashes, one Load of Lime, one Load of Lome, and one of Sand.

Another Person of the same Trade us'd only Lime and Soap-Ashes, tempered and wrought together for Mortar; with which he laid both the Foundations, Chimnies, and their Tunnels, in his Dwelling-house in *Southwark*; which have endur'd and stood out those Storms which have overturn'd many other Tunnels, both new and old, which were built with common Mortar.

It is true indeed, this kind of Mortar is somewhat rough in the laying, and more sharp and fretting to the Fingers than common Mortar; which may be the Reason why it is so much neglected and decry'd by Workmen.

But these two Inconveniences might be easily remedied; and indeed its Roughness is so far from being a Fault, that it is rather an excellent Quality in the Mortar. But this may be remedied, by grinding or stamping the Soap-Ashes (which are in hard Cakes) to a fine Powder, before they are mix'd with the Sand, which will soon bring it to a smooth Temper.

Nor will the Charge be much; the Profit of one Day's Labour will answer the Charge of three Mens Wages, in the Difference of Price that will be found betwixt one Load of these Ashes and one Hundred of Lime.

Secondly, As to the *Sharpness* wherewith it offends the Workmens Fingers, that may be avoided by wearing Gloves (without which they seldom lay any Brick at all) to avoid the like Effects which they find in Lime.

Or, for an assured Remedy in these Cases; these Ashes may be re-imbib'd in Water for a considerable Time, till more of their Salt be extracted from them; and then much of their fretting Nature being taken away, they will be found to be gentle enough.

For laying Tiles, in some Places they make a kind of Mortar of Lome and new Horse Dung well tempered and mix'd together: And this is by some Workmen accounted a good, strong, and cheap Mortar, which is more suitable to Tiles than the common Mortar made with Lime and Sand, which they say corrodes and frets the Tiles, and causes them to scale and fly to pieces; which this does not.

For the plaistering the Fronts of Houses in imitation of *Brick-work*; Some Workmen make Mortar for this sort of Work, of Powder of Brick, sharp Sand and Lime, and some red Oker. Some Houses plaistered with this kind of Plaister, look very well, tho' they have been done 20 or 30 Years, and may be taken, by one passing by, for a Brick House, tho' it be only

Timber

Timber plaistered over. The Workman has for this sort of Work commonly 1 *s. per* Yard, only for Workmanship.

How much allow'd to a Rod of Brick-work, or a Square of Tileing.] Workmen usually allow a Hundred and half (or 37½ Bushels) of Lime, and two Load (or 72 Bushels of Sand) to make Mortar enough for a Rod of Brick-work.

And for Tileing; four Bushels of Lime, and six or eight Bushels of Sand, will make Mortar enough for laying 1000 of Tiles, which is about a Square and a half; so that a Square of Tileing will take up, for Mortar, about 2⅔ Bushels of Lime, and about five Bushels of Sand.

A Caution.] It is a general Caution in all Parts of a Building, that where either Stones or Bricks are contiguous to Wood, they ought to be laid, dry, or without Mortar; because Lime and Wood are unsociable; the Lime very much corroding and decaying the Wood.

MORTOISE } [in *Carpen-*
MORTISE } *try*, &c.] is a kind of Joint, wherein a Hole or Incision of a certain Depth is made, in the Thickness of a Piece of Wood, which is to receive another Piece, call'd a Tenon.

MOSAIC WORK } Is a cu-
MOSAIQUE } rious Piece of Work, or an Assemblage of Marble, pretious Stones, Pebbles, Pieces of Glass, *&c.* to Cockles and Shells of various Colours, cut square, and cemented on a Ground of Stuck, *&c.* in imitation of the natural Colour and Degradation of Painting.

As to the Name *Mosaic*, some derive it of *Musaicum*, as that is of *Musivum*, as it was call'd among the *Romans*. *Scaliger* derives it of *Moûsan*, *Gr.* and imagines the Name was given to this Sort of Work, as being fine and ingenious.

Mosaic Work seems to have taken its Origin from *Paving*. The fine Effect and Use of Pavements, compos'd of Pieces of Marble of different Colours, so artfully and neatly join'd together, that when the Work is dry, it may be polish'd, and the whole make a very beautiful and solid Body, which being continually trodden upon and wash'd with Water, was not at all damag'd, gave the Hint to the Painter, who in a little Time carried the Art to a much higher Degree of Perfection, so as to represent Foliages, and Grotesque Pieces of various Colours on a Ground of Marble, either white or black.

In fine, the good Effect of this Kind of Work in Pavements, being observ'd, and also its Quality of resisting Water, Artists proceeded farther, and also lin'd Walls with it, beautified with various Figures, for adorning Temples, and other publick Buildings.

But Nature not having produc'd a sufficient Variety of Colours for them in Marbles to represent all Kinds of Objects, they bethought themselves of counterfeiting them with Glass and

and Metal Colours, they having given Teints of all Manner of Colours, to an infinite Number of Pieces of Glaſs and Metals to counterfeit Stones of various Colours, the Deſign ſucceeded ſo well; the Workmen arrang'd them with ſo much Art, that their Moſaic ſeem'd to almoſt vye with Paintings.

This Way of repreſenting Objects having this Advantage that it reſiſts the Injuries of the Air as well as Marble it ſelf; and even grows more beautiful by Time; which effaces all other Kinds of Paintings.

But the Moderns have gone beyond the Ancients; and ſetting aſide Materials of Glaſs and Metals, have intermixt with the fineſt Marbles, the richeſt of precious Stones; as *Agats*, *Cornelians*, *Emeralds*, *Lapis*, *Turquoiſes*, &c.

So that the Moſaic Work of Glaſs and Metals, is now little in Uſe; tho' even they are of a ſurpriſing Beauty and Durableneſs: But that which is in the moſt common Uſe, is that of Marble alone; the Moſaic of precious Stones being ſo very coſtly, that ſcarce any but very ſmall Works are made with them: As Ornaments for Altar-Pieces, Tables for rich Cabinets, *&c.*

Tho' out of theſe muſt be excepted, that ſumptuous Chapel of the Dukes of *Tuſcany*, which has been ſo long in Hand, and which, if it be ever finiſh'd, will be a noble Monument of the Magnificence and Piety of thoſe Princes, as well as the Patience and Addreſs of the Workmen employ'd in that Work.

Moſaic Work of Glaſs.

This Work is begun with little Pieces of Glaſs, which they provide of as many different Colours as poſſible.

For this Purpoſe the Glaſs-Makers Furnaces being prepar'd and put in Order, and the Pots or Crucibles full of the Matter of which Glaſs is made, or rather of Glaſs, already made; they put what Colours they think proper into each Crucible, always beginning with the weakeſt, and augmenting the Strength of the Colours from Crucible to Crucible, till they come to the deepeſt Shade or Teint, much after the Manner of mixing Oil Colours on a *Palette*. When the Glaſs has been well melted and ting'd with all the Colours to Perfection, the Crucibles are taken hot out of the Furnace, and the Glaſs is poured on a ſmooth Marble, and ſo cut into Slices of an Inch and an half thick.

Then with an Inſtrument which the *Italians* call *Bocca di Cane*, they make ſome Pieces ſquare, and others of different Figures and Sizes, according as the Deſign requires.

The Pieces are orderly diſpoſed in Caſes; as in Painting *in Freſco* it is uſual to range all the different Teints in Shells, and according to their Colour.

If they would have a Gold Colour, either in the Ground of the Painting, or in the Ornaments, or the Draperies, they

take

ke ſome of the Pieces of Glaſs, rm'd and cut in the Manner fore mentioned. Theſe they oiſten on one Side with Gum ater, and afterwards lay Leaf old on it.

They then put this Piece, or veral Pieces at a time, on a ire-ſhovel, which they place the Mouth of the Furnace, fter having firſt covered them ith another hollow Piece of laſs.

Here they continue till ſuch ime as they become red hot; fter which the Shovel is drawn ut all at once, and the Gold ecomes ſo firmly attach'd to e Glaſs, as never afterwards be ſeparated from it.

Now, to apply theſe ſeveral ieces, and to form a Picture ut of them, they have a Caroon or Deſign firſt drawn: This s transfer'd on the Ground or laiſter by calking, as in paining *in Freſco*.

As this Plaiſter is to be laid hick on the Wall, it will coninue freſh and ſoft a conſiderble time; ſo that there may e enough prepared at once to erve three or four Days.

This Plaiſter is compoſed of Lime, made of hard Stone, with rick Duſt made very fine, um Tragacanth, and Whites f Eggs. When this has been repar'd and laid on the Wall, nd the Deſign of what is to be epreſented drawn on it, they ake out the little Pieces of laſs with Plyers, and range hem one after another, ſtill eeping ſtrictly to the Light nd Shadow, different Teints nd Colours before repreſented in the Deſign; preſſing or flatting them down with a Ruler; which both ſinks them within the Ground, and at the ſame time renders the Surface even.

After this manner, in much Time, and an almoſt infinite deal of Trouble, they at length finiſh the Work; which is ſtill the more beautiful as the Pieces of Glaſs are the more uniform, and ranged at more equal Heights.

Some of theſe Pieces have been executed with ſo much Juſtneſs, that they appear as ſmooth as a Table of Marble; and as finiſh'd and as maſterly as a Painting *in Freſco*; with this Advantage, that they have a fine Luſtre, and will laſt almoſt for ever.

The fineſt Works of this Kind that have been preſerved to our Time, and thoſe from which the Moderns have retriev'd the Art, which was almoſt loſt, are thoſe of the Church of St. *Agnes*, formerly the Temple of *Bacchus* at *Rome*; at *Piſa*, *Florence*, and other Cities of *Italy*.

The moſt eſteemed among the Works of the Moderns, are thoſe of *Joſeph Pine*, and the Chevalier *Lanfranc*, in the Church of St. *Peter* at *Rome*: But there are alſo very good ones at *Venice*.

Moſaic Work *of Marble and precious Stones.*

Theſe two Kinds of *Moſaic* bear ſo near a Relation to each other as to the manner of working, that to avoid Repetition, I ſhall give them both under

under one; observing by the way, wherein the one is different from the other.

Mosaic of Marble is us'd in large Works, as in Pavements of Churches, Basilisks and Palaces; and Incrustation and vanneering the Walls of the same Edifices.

As to *Mosaic*, of or with Stones, especially *precious Stones*, it is only used in small Works, as has been before observ'd.

The Ground of *Mosaic* Works, wholly of Marble, is usually a massive Marble, either white or black. On this Ground the Design is cut with a Chisel, having been first calked.

When it has been dug of a sufficient Depth, *i. e.* an Inch, or more, 'tis filled up with Marble of a proper Colour, first contourniated or fashioned to the Design, and reduc'd to the Thickness of the Indentures with various Instruments.

To make the Pieces thus inserted into the Indentures, hold the several Colours which are to imitate those of the Design, they use a Stuck composed of Lime and Marble Dust; or a Mastick; which different workmen prepare different ways; after which the Work is half polish'd with a kind of soft Stone.

The Figures being mark'd out, the Painter or Sculptor himself draws with a Pencil the Colours of the Figures not determined by the Ground, and in the same manner makes Strokes or Hatchings in the Places where the Shadows ought to be; and when he has engraven with the Chisel all the Strokes thus drawn, he fills them up with a black Mastick compos'd partly of *Burgundy* Pitch, poured on hot; afterwards taking off what is superfluous, with a Piece of soft Stone or Brick; which together with Water and beaten Cement takes away the Mastick, polishes the Marble, and renders the Whole so even, that it seems as if it consisted but of one intire Piece.

It is this kind of *Mosaic* that is seen in the pompous Church of the *Invalids* at *Paris*, and the fine Chapel at *Versailles*; and with which some intire Apartments of that Palace are incrustated.

As for *Mosaic Work of precious Stones*, other and more delicate Instruments are required, than those that are used in Marbles; as Wheels, Drills, Tin-plates, &c. such as Lapidaries and Engravers on Stone use.

As none but the richest Marbles and Stones enter this Work, in order to make them go the farther, they are sawn into the thinnest Leaves that can be, scarce exceeding half a Line in Thickness. The Block that is to be sawn, is fastened firmly with Cords on the Bench, only raised a little on a Piece of Wood of one or two Inches high.

The Saw is directed by two iron Pins, which are on one Side of the Block, and which also serve to fasten it; which with the Pieces so sawn are put into a Vice contrived for that Pur-

Purpoſe; and with a kind of Saw, or Bow, made of fine Braſs Wire, bent on a Piece of ſpringy Wood, together with Emery ſteep'd in Water, the Leaf is gradually faſhioned, by following the Strokes of the Deſign made on Paper, and glued on the Piece.

When there have been Pieces enough faſtened to form an intire Flower, or ſome other Part of the Deſign, they are applied. The Ground that ſupports this *Moſaic*, is uſually of Free Stone. The Matter wherewith the Stones are joined together, is a Maſtick, or kind of Stuck, laid very thin on the Leaves as they are faſhioned; and the Leaves in this State are applied with Pliers.

If any Contour or Side of a Leaf be not either rounded enough or ſquared enough to fit the Place where it is to be uſed; when 'tis too large, 'tis brought down with a Braſs File or Raſp; and when too ſmall, is manag'd with a Drill and other Inſtruments uſed by Lapidaries.

The Manner of making Moſaic Work *of Gypſum.*

The Gypſum is a kind of courſe Talc, or a ſhining tranſparent Stone found in the Quarries of *Montmartre* near *Paris*, among the Stones dug out of that Quarry, with which the Plaiſter of *Paris* is made. It is different from the Plaiſter; but retains the Name the *Romans* gave the Plaiſter, *viz.* *Gypſum.*

A kind of artificial Marbles are made of this Stone, calcin'd in a Kiln, and pounded in a Mortar, and afterwards finely ſifted. Theſe Marbles imitate precious Stones; and of theſe they compoſe a kind of *Moſaic* Work; which does not fall far ſhort, either in Durableneſs or Vivacity, of the natural Stones; and beſides, it has this Advantage, that it admits of contitinued Pieces or Paintings of intire Compartments, without any viſible Joinings.

Some make the Ground of Plaiſter of *Paris*; others of Free Stone. If it be made of Plaiſter of *Paris*, it is ſpread on a wooden Frame, of the Length and Breadth of the Work it is deſigned for, and about an Inch and half in Thickneſs. This Frame is ſo contrived that the Tenons being only joined to the Mortoiſes by ſingle Pins, they may be taken aſunder, and the Frame diſmounted when the Plaiſter is dry.

This Frame is covered on one Side with a ſtrong linen Cloth, nail'd all around; which being plac'd horizontally, with the Cloth at the Bottom, is filled with Plaiſter paſs'd through a wide Sieve.

The Plaiſter being grown half dry, the Frame is ſet up perpendicular, and let ſtand ſo, till it is quite dry; and then is taken out, by diſmounting the Frame.

In this Kind of *Moſaic*, the Ground is the moſt important Part.

The

The Method of preparing this ſifted *Gypſum*, which is to be apply'd on this Ground, is by diſſolving and boiling it in *Engliſh* Glue, and afterwards mixing with it the Colour that it is to bear: The Whole being work'd up together in the ordinary Conſiſtence of a Plaiſter; and then it is taken and ſpread on the Ground five or ſix Inches thick.

This is to be obſerv'd: If the Work be ſuch as that Mouldings are requir'd, they are form'd with Gouges and other Inſtruments.

On this Plaiſter thus colour'd like Marble or precious Stone, and which is to ſerve as a Ground to a Work, either of *Lapis*, Agate, Alabaſter, or the like, the Deſign to be repreſented is drawn; having been firſt pounced or calked, to hollow or impreſs the Deſign; the ſame Inſtrument is us'd as is us'd by Sculptors; the Ground on which they are to work not being much leſs hard than Marble it ſelf. The Cavities being thus made in the Ground, are filled up with the ſame Gypſum boil'd in Glue; only differently colour'd: And after this manner are the Colours in the Original repreſented.

That they may have the neceſſary Colours and Teints at hand, they firſt temper Quantities of the Gypſum with the ſeveral Colours in little Pots.

When they have thus filled the Deſign, and render'd it viſible by half poliſhing it with Brick or ſoft Stone, they go over it again, cutting ſuch Places as are either to be weaker or more ſhadowed, and filling them with *Gypſum*; which is repeated till all the Colours added one after another, repreſent the Original to the Life.

The Work being finiſh'd, it is ſcowred with ſoft Stone, Sand and Water; then with Pumice, and poliſh'd with a wooden Mullet and Emery.

Laſtly, the Luſtre is given it by ſmearing it over with Oil, and rubbing it a long Time with the Palm of the Hand; which gives it a Luſtre nothing inferior to that of natural Marble.

If it be only requir'd to make a variegated Table, or other Work of ſeveral Colours, without *Moſaic* Figures, the Proceſs is ſomewhat different.

To perform this, they only prepare ſeparately as many different Colours as the Work requires, in Imitation of Marble: Theſe are put into large Pans or Bowls, and after they have been incorporated in the *Gypſum* and Glue Water, they take a Trowel full of each, and diſpoſe them in a Trough without any Order; then without mingling them, and only by cutting or croſſing the *Gypſum* of each Trowel once or twice with each of the Reſt, they give them that beautiful Confuſion, which makes the Value of natural Marbles: Of theſe they make their Tables, or lay them in a Mould, according to the Work to be done.

MOSS [*us'd in Tiling*]. In ſome Places in the Country they lay Tiles in Moſs inſtead

of Mortar: But this is disapprov'd by some Workmen, because they say, in windy, wet Weather, when the Wet, Rain, Slow, or Sleet is driven under the Tiles in the Moss, if a Frost follows while the Tiles are wet, it then freezes the Moss, and so raises the Tiles out of their Place.

MOTION is a continual and successive Mutation of Place, and is either Absolute or Relative.

1. *Absolute* Motion is the Change of the *Locus Absolutus* of any moving Body; and therefore its Celerity will be measured by the Quantity of the Absolute Space, which the moveable Body hath run thro'. But,

2. *Relative Motion*, is a Mutation of the Relative or Vulgar Place of the moving Body, and so hath its Celerity accounted or measured by the Quantity of Relative Space, which the moveable Body runs over.

3. All Motion is of it self rectilinear, or made according to strait Lines, with the same constant uniform Velocity, if no external Cause makes any Alteration in its Direction.

4. If two Bodies moving uniformly, go with unequal Velocities, the Spaces which will be pass'd over by them in unequal Times, will be to one another in a Ratio, compounded of that of the Velocities, and that of the Times.

5. The Motions of all Bodies, are as the Rectangles under the Velocities, and the Quanties of Matter.

6. The Motions of Bodies included in a given Space among themselves, will not be changed by the Motion of that Space uniformly forwards in a strait Line.

7. Every Body will continue in its State, either of Rest or Motion uniformly forward in a right Line, unless it be made to change that State by some Force impress'd upon it.

8. The Change of Motion is proportionable to the moving Force impress'd, and is always according to the Direction of that Right Line, in which the Force is impress'd.

9. The Quantity of any Motion is discoverable by the joint Consideration of the Quantity of Matter in, and the Velocity of the moving Body; for the Motion of any whole is the Sum of the Motions of all the Parts.

10. The Quantity of Motion which is found by taking either the Sum of the Motions made the same Way, or the Difference of those which are made the contrary Ways is not at all changed by the Actions of the Bodies one upon another.

11. In all kind of Motions whatever, *Rolling*, *Sliding*, uniform, accelerated or retarded, in right Lines or in Curves, *&c.* the Sum of the Forces which produce the Motion of all Parts of its Duration, is always proportionable to the Sum of the Paths or Lines, which all the Points of the moving Body describe.

12. The Product of the Du-

ration of all uniform Motion, multiply'd by the Force, which began the Motion, is always proportional to the Product made by the Path or Line of Motion, multiply'd by the Mass or Quantity of Matter in the moving Body.

MOTION [in *Mechanicks*] is the opposite to the Rest, it is either general or particular, and those are either Regular or Irregular.

Motion in general, is the *Change* of a Thing; and when that *Change* is made in the Quantity, it is call'd an *Increase* or *Diminution*.

Again, when the Change is made, in Respect to Place, it is call'd *Place Motion*, or *Local Motion*.

Local MOTION } [in *Mechanicks*]
Place MOTION }
is the change of Place, or it is the continual Passage of a Body that moves from one Place, as the Passage of the Body A, from the Place B, into the Place C. For by its being mov'd to C, it has chang'd its Place from B to C.

Secondly, If the Body A, as it moves to C, goes through equal Spaces in equal Times, then its Motion is said to be *equal*; that is, if B *d* is = *d e*, and the Body A pass from B to *d*, in the same Time as it does from *d* to *e*, then it will have pass'd through equal Spaces in equal Times, whereby its Motion is said to be *regular* or *equal*.

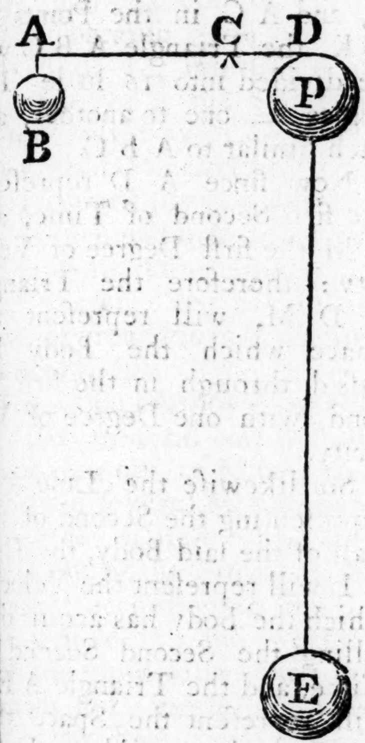
But if the Body A had mov'd from *d* to *e*, in less Time than it did from A to *d*, then its Motion had been irregular; because it would have pass'd through equal Spaces in unequal Times.

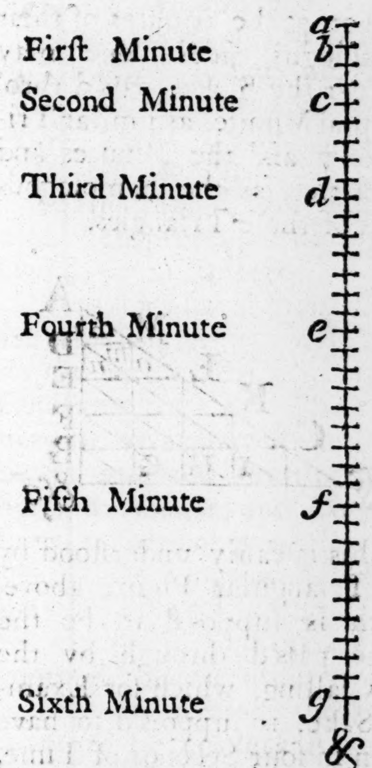
Hence, (as *Galilæus* observes) an irregular Motion is natural to all heavy Bodies, which he justly terms a *Motion uniformly accelerated*, as a Body drop from the Top of a Steeple to the Earth, which in equal Times, passes through unequal Spaces.

That is to say, that dividing the Time it takes up in falling into equal Spaces, as Minutes Seconds, &c. The Velocity of the falling Body at the End of the second Minute, &c. is double what it was at the End of the first, being reckon'd from the Point or Beginning of its Rest or Fall.

And that the Velocity which it acquires in the third Minute &c. is triple of that which it had at first. And the Velocity of the fourth Minute. &c. four times that of the first, and so on in like Proportion of all other.

Thus if in the first Minute Body falls from *a* to *b*; in the second Minute it will have fallen to *c*, and have pass'd thr three times the Space of *a* which with the Space *a b*, equal to four, which is the Square of two, the Number Minutes.





Again.

t the End of the third Mi-
e it will have fallen to D,
have pass'd through five
es the Space *a b*, which
n the Space *a b*, and *b e*, is
al to 9, which is the Square
, the Number of Minutes
Time of falling; and so in like Manner of all other Minutes, &c.

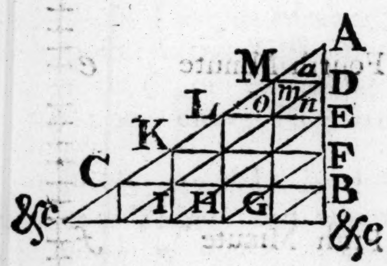
Hence it follows, that the Spaces through which Bodies fall, are as the Squares of the Times or Minutes, &c. in falling; that is if in one Minute a Body falls one Foot.

Then in	2	It will have fallen	4	From the Point of Rest.
	3		9	
	4		16	
	5		25	
	6		36	
	7		49	
	8		64	
	9		81	
	10		100	
	&c.		&c.	

ence it is evident that the
ease of Motion in every
ute, &c. is according to
Series of the uneven Num-
1, 3, 5, 7, 9, 11, &c. which are the Differences of the Squares, 1, 4, 9, 16, 25, 36, &c.

By the *fourth Prop. 6 Lib. Euclid.* similar ▽ are to one another

another, as the Squares of their Homologus Sides; one may consider the Spaces pass'd thro' in equal Minutes as similar Triangles ▽ and the Minutes and Velocities, as the homologous Sides of those Triangles.



This is easily understood by the Triangular Figure above, which is suppos'd to be the Space pass'd through by the Body falling, which for Example Sake, is suppos'd to have fallen in four Seconds of Time, whose Measure is represented by the Side A B, equally divided at D E F B into four = Parts; and the Base B C shall likewise represent the Velocity which the Body has acquir'd in falling.

Now as each of the equal Parts, A D, D E, E, F, and F B, represent one Second of Time: so likewise, if B C be divided into four equal Parts, as B G, G H, H I, and I C, each of those Parts, will represent one Degree of Velocity, because 'tis suppos'd, that the Velocities and Seconds increase continually in the same Proportion.

Again.

If from the Points I H G, you draw Right Lines parallel to A C, and to A B, also intersecting A B, in the Points D E F, and A C in the Points M L K, the Triangle A B C wi[ll] be divided into 16 little Tr[i]angles = one to another, an[d] each similar to A B C.

Now since A D represen[ts] the first Second of Time, an[d] D M the first Degree of Velo[-] city: therefore the Triang[le] A D M, will represent th[e] Space which the Body ha[s] pass'd through in the first Se[-] cond, with one Degree of Ve[-] locity.

So likewise the Line A E representing the Second of th[e] Fall of the said Body, the Lin[e] E L will represent the Velocit[y] which the Body has acquir'd i[n] falling the Second Second o[f] Time, and the Triangle A E[L] will represent the Space th[at] the Body has pass'd thro' wit[h] two Degrees of Velocity, whic[h] triangular Space A E L is equ[al] to four Times A D M; becau[se] the ▽ *a* is = equal to the ▽ [...] and the triangle *m*, is equal [to] the ▽ *n*, and the Triangle *n* [is] equal to the ▽ *o*; therefo[re] the ▽ A E L, is equal to fo[ur] times the ▽ A D M, and so [in] like Manner of all other equ[al] Spaces of Time.

Hence it is evident, th[at] the Velocity with which hea[vy] Bodies descend, is according [to] the Squares of their Times;

So whatever Space a Bo[dy] passes through, by falling [in] one Second, or one Minute, &[c.] So many times that first Spa[ce] the Body falls, are equal to t[he] Square of its times.

That is, if a Body falls o[ne] Foot in one Minute, then it w[ill] have fallen 100 Foot in 10 M[i-] nut[es]

tes, and 144 Foot in 12 Mi-
ites, because 100 is the
uare of 10, multiply'd by
, and 144 is the Square of
, multiply'd by 12.

MOULD [in *Mechanic Arts*]
Cavity artfully cut, with De-
n to give its Form or Impres-
n to some softer Matter ap-
ied therein, and are Instru-
ents of great use in Sculpture,
oundery, *&c.*

Workmen employ'd in melt-
g the mineral or metallic
lebe dug out of Mines, have
ch their several Mould, to re-
ive the melted Metal as it
mes out of the Furnace; but
fferent according to the Di-
rsity of Metals and Works.

In the Gold Mines they have
oulds for Ingots, in Silver
ines for Bars, in Copper or
ead Mines for Pigs or Sal-
ons, in Tin Mines for Pigs
d Ingots, and in Iron Mines
Sows, Chimney-Backs, An-
s, Caldrons, Pots, and other
ge Utensils and Merchandi-
s of Iron, which are here
t, as it were at the first
and. See CENTRE.

MOULDINGS [in *Archi-
tecture*] are Projectures beyond
e naked of a Wall, Column,
ainscot, *&c.* the Assemblage
which, forms Cornishes,
oor-Cases, and other Pieces
Architecture, which only
ve for Ornament; whether
y be square, round, strait or
ooked: Of these there are
en Kinds more considerable
n the Rest, *viz.* the *Dou-
e*; the *Talon* or *Heel*; the
olo, or *Quarter Round*; the
inth, the *Astragal*, the *Den-
ticle*, and the *Cavetto*.

Some *Mouldings* are crown'd with a *Fillet*, others are without, as the *Doucine*, *Talon*, *Ovolo*, *Torus*, *Scotia*, *Astragal*, *Gula*, *Corona*, &c.

Again, Some are adorn'd with Sculptures, either hollowed, or in Relievo.

Mouldings [in *Architecture*] are what Letters are in *Writing*. By the various Dispositions and Combinations of *Mouldings*, may be made an infinite Number of different Profiles for all Sorts of Orders and Compositions, regular or irregular, and yet all the Kinds of *Mouldings* may be reduc'd to three, *viz.* square, round, and mixed; *i. e.* compos'd of the other two.

For this Reason, those who invented the *Gothick* Architecture; resolving to recede from these perfect Figures, and affecting to use others less perfect, to distinguish their Architecture from the Antique, introduc'd a new Set of whimsical *Mouldings* and Ornaments.

Regular *Mouldings* are either large, as *Doucines*, *Ovolos*, *Gulas Talons*, *Scotia's*, &c. or small, as *Fillets*, *Astragals*, *Conges*, &c.

Mr. *Le Clerc* says, that Ornaments are not always us'd on *Mouldings*, barely to inrich them, but sometimes also to inrich, and sometimes also to distinguish them the better from one another.

As the Generality of *Mouldings*, and in particular those of Cornishes are only illumin'd by Reflection, they would be frequently confounded and lost, if

they were all ſimple and uniform; but a few Ornaments cut ſome one Way, and ſome another, diſtinguiſh them advantageouſly from each other.

Thus the Eggs have a noble Effect underneath the Larmier of the *Ionick* Order, or underneath the ſquare Member, whence the *Modillions* proceed in the *Corinthian*, as in his Figure 67; becauſe thoſe Ornaments, being cut ſtrong and bold, make an agreeable Difference between the *Mouldings* that accompany them.

Among theſe Ornaments, ſome ſtand prominent from the *Mouldings*, and others are cut within them, as may be obſerv'd in the ſeveral Figures of his 118 Plate.

Ornaments, he ſays, are not to be beſtow'd indifferently every where upon *Mouldings*; ſome Members or *Mouldings*, muſt be reſerv'd plain to ſet off the Reſt, and without the Simplicity and Plainneſs of theſe, the Richneſs of Ornaments would only make a Confuſion in Architecture, a ſenſible Inſtance of which we have in the *Corinthian* Profile taken from the Baths of *Diocleſian*, and mention'd in the Parallel of M. *de Chambray*. The *Corona* for Inſtance, is the firſt maſter *Moulding* in the *Corniche*, which will not admit of Ornaments, the *Faces* of the *Architrave*, the *Fillets*, *Liſt* or *Liſtels*, the *Aſtragal*, and all the Parts of the *Baſe*.

MOULINET [in *Mechanicks*] 'tis us'd to ſignify a *Roller*, which being croſsd with 2 *Levers*, is uſually apply'd to Cranes, C[...] ſtans and other Sorts of Engi[...] of the like Nature, to draw Co[...] and raiſe Stones, Timber & ſu[...] like heavy Materials. Alſo a ki[...] of *Turn-Stile* or wooden Cro[...] which turns horizontally upo[...] Stake fix'd in the Ground, and [...] uſually plac'd in Paſſages to ke[...] out Horſes, and oblige Paſſe[...] ers to go and come one by on[...]

MOVEMENT [in *Mech*[...] *ricks*] is the ſame that is by ſo[...] call'd an *Autometon*, and with [...] ſignifies all thoſe Parts of a Clo[...] Watch or any ſuch curious E[...] gine, which are in Motion, ca[...] on the Deſign, or anſwer [...] End of the Inſtrument.

MULTANGULAR Fig[...] or Body, is one that has ma[...] Angles or pointed Corners.

MULTILATERAL [...] *Geometry*] is ſaid of thoſe [...] gures which have more th[...] four Sides or Angles.

MULTINOMIAL *Roots* [...] *Mathematicks*] are ſuch as [...] compos'd of many Nam[...] Parts or Members.

MULTIPLE } [in *Ari*[...]
MULTIPLEX } *meti*[...]
a Number which comprehen[...] ſome other Number ſeve[...] Times.

Thus 6 is a *Multiple* of 2; which is the ſame; 2 is a qu[...] ta Part of 6; 2 being contai[...] in 6, 3 times, and thus 12 i[...] *Multiple* of 6, 4, 3, and co[...] prehends the firſt, twice; [...] ſecond, three Times, and [...] third, four times.

MULTIPLE *Proportion* [...] when the antecedent being di[...] ed by the Conſequent, the Q[...] tient is more than Unity; [...]

he Reason of the Name is, be-
ause the Consequent must be
nultiply'd by the Index or Ex-
onent of the Ratio to make it
qual to the Antecedent.

Thus 12 is the *Multiple* in
Proportion to 4, because being
ivided by 4, the Quotient is
, which is the Denomination
f the Ratio; and the Conse-
quent 4 being multiply'd by 3,
nakes the Antecedent 12,
wherefore 3, is the *Sub-multi-
ple* of 12.

A *Sub-multiple* Number is
hat contain'd in the *Multiple*,
hus, the Number 1, 2, and 3,
re *Sub-multiples* of 6 and 9.

MULTIPLICAND [in *A-
rithmetick*] is the Number to
be multiply'd.

MULTIPLICATOR is the
Number by which you multi-
ply, or the Number multiplying.

MULTIPLICATION, is in
general, the taking or repeat-
ing of one Quantity, as often
as there are suppos'd Unites in
he other Number; the Num-
ber multiply'd is call'd the
Multiplicand, the Number mul-
tiplying, the *Multiplicator*, and
that which is found or produc'd
is call'd the *Product*.

Multiplication is only a
compendious Addition, effect-
ing at once, what in the ordi-
nary Way of Addition would
require many Additions; for
the *Multiplicand* is enly added
to itself or repeated as often as
the Unites of the *Multiplica-
tor* do express it.

Thus if 6 were to be multi-
ply'd by 4, the Product is 24,
which is the Sum arising from
the Addition of 6 four times to
itself.

In all Multiplication, as 1 is to the Multiplicator, so is the Multiplicand to the Product.

Cross MULTIPLICATION, or Multiplication of Feet and Parts.

Example 1. Let 7 Feet 9 Inches be multiply'd by 3 Feet 6 Inches.

F.	I.	
7	9	
3	6	
23	3	Pts.
3	10	6
27	1	6

First, multiply 9 Inches by 3, saying 3 times 9 is 27 Inches, which make 2 Feet 3 Inches; set down 3 under Inches, and carry 2 to the Feet, saying 3 times 7 is 21, and 2 that I carry makes 23; set down 23 under the Feet.

Then begin with 6 Inches, saying, 6 times 9 is 54 Parts; which is 4 Inches and 6 Parts; set down 6 Parts, and carry 4, saying 6 times 7 is 42, and 4 that I carry is 46 Inches, which is 3 Foot 10 Inches, which set down, and add all up together, and the Product will be 27 Feet, 1 Inch, and 6 Parts.

Example 2. Multiply 75 Feet 7 Inches, by 9 Feet 8 Inches.

F.	I.
75	7
9	8
680	3
50	4 : 8
730	7 : 8

First, Multiply by 9 Feet, ſaying 9 times 7 is 63, which is 5 Feet 3 Inches; ſet down 3 and carry 5, ſaying 9 times 5 is 45, and 5 I carry is 50; ſet down o and carry 5, ſaying 9 times 7 is 63, and 5 that I carry is 68, ſet down 68, and proceed to multiply by 8 Inches, ſaying, 8 times 7 is 56, the twelves in 56 are 4 times, and there remains 8; ſet 8 in a Place to the right Hand, and carry 4; then multiply 75 by 8, and the Product is 600, and 4 that I carry is 604, which divided by 12, the Quotient is 50 Feet, and 4 remains; then ſet down 50 Feet and 4 Inches, and add all together, and you will find the Product 730 Feet, 7 Inches, 8 Parts.

I ſhall ſhew another Way of working the laſt Example, which in my Opinion is better and more expeditious, when there are more Figures than one in the Feet, thus.

F.	I.	
75	7	
9	8	
680	3	
25	2	4
25	2	4
730	7	8

Multiply by 9 Feet firſt, as above directed; then inſtead of multiplying by 8 Inches, let the 8 Inches be parted into ſuch aliquot or even Parts of a Foot, as you find to be contain'd in that Figure; if you take ſuch Parts of the Multiplicand and add them to the former Product, the Sum will give the Anſwer.

Thus 8 Inches may be parted into 4 and 4, becauſe 4 is the third Part of 12. So that if you take the third Part of 75 Feet 7 Inches, and ſet it down twice and add all together, the Sum will be 730 Feet 7 Inches 8 Parts, the ſame as before.

Thus, ſay how often 3 in 7, which is twice, ſet down 2; then becauſe twice 3 is 6, ſay 6 out of 7, and there remains 1, for which you muſt add 10 to the 5, and it makes 15; then the 3 in 15 are 5, ſet down 5, and becauſe 3 times 5 is 15, there is o remains.

Then go to the 7 Inches, ſaying the threes in 7 are twice; ſet down 2 in the Inches; and becauſe twice 3 is but 6, take 6 out of 7, and there remains 1 Inch, which is 12 Parts, then the threes in 12 are 4 times, and o remains. So the third Part of 75 Feet 7 Inches, is 25 Feet, 2 Inches, 4 Parts; which ſet down again, and add all together; and the Sum will be 730 Feet, 7 Inches, 8 Parts, the ſame as before.

Example 3. Let 97 Feet 8 Inches, be multiply'd by 8 Feet 9 Inches.

F.	I.
97	8
8	9
481	4
48	10
24	5
854	7

Begin firſt to multiply 8 Feet, ſaying 8 times 8 is 64 Inches, that is 5 Feet 4 Inches; ſet down 4 Inches and carry 5, ſaying

ing, 8 times 7 is 56, and 5 arry, is 61; ſet down 1 and rry 6, ſaying 8 times 9 is 72, d 6 I carry is 78, which ſet wn: Then inſtead of multiying by 9 Inches, take the liquot Parts of 12, which 9 kes, which is 6 and 3, 6 Ines being half 12, and 3 the rth Part; therefore take e half of 97 Feet 8 Inches, ich is 48 Feet 10 Inches; and cauſe 3 is half of 6, you may e the half of 48 Feet 10 Ines, which is 24 Feet 5 Inches; d all up together, and the m is 854 Feet 7 Inches.

Example 4. Multiply 75 Feet Inches, by 17 Feet 7 Inches.

F.		I.	
75		9	
17		7	
525			
75			
25	:		3 *parts.*
18	:	11	3
8	:	6	
4	:	3	
1331	:	11 : 3	

In this Example, becauſe ere are more than 12 Feet in e Multiplier, therefore I firſt ltiply the 75 by 17 Feet, en becauſe the Aliquot Parts 7 Inches are 4 and 3, that is, hird and a fourth, take the rd Part of 75 Feet 9 Inches, ich is 25 Feet 3 Inches, and fourth Part thereof is 18 et 11 Inches, 3 Parts, and n the Aliquot Parts of 9 Ins, are 6 and 3, that is a half and a fourth; therefore I take half 17 Feet, which is 8 Feet 6 Inches, and the fourth, is 4 Feet 3 Inches (not meddling with the 7 Inches, becauſe that was multiply'd into the 9 before) then add all theſe together, and the Sum is 1331 Feet, 11 Inches, 3 Parts.

Example 5. Let 87 Feet 5 Inches, be multiply'd by 35 Feet 8 Inches.

F		I.		P.
87	:	5		
35	:	8		
435				
261				
29	:	1	:	8
11	:	8	:	0
2	:	11	:	0
3117	:	10	:	4

Work this as the laſt Example; after you have multiply'd the Feet, then take the Aliquot Parts of 8 Inches, which is two thirds; therefore take the third Part of 87 Feet 5 Inches, which is 29 Feet, 1 Inch, 8 Parts; ſet this down twice; then the Aliquot Parts of 5 Inches, are 4 and 1, that is; a thi d Part and a twelfth Part; therefore take a third Part of 35, which is 11 Feet 8 Inches, and a twelfth Part of 35 Feet, is 2 Feet 11 Inches; ſet all theſe one under another, and add them together, and the Sum will be 3117 Feet, 10 Inches, 4 Parts.

Example 6. Multiply 259 Feet

Feet 2 Inches, by 48 Feet 11 Inches.

F.	I.	P.
259	2	
48	11	
20072		
1036		
129	7	
86	4	8
31	7	2
8	0	0
12677	6	10

First. Multiply the Feet; then take the Aliquot Parts of 11, which will be 6 4 and 1; that is, a half, a third, and a twelfth; therefore take the half of 259 Feet, 2 Inches, which is 129 Feet 7 Inches, and a third Part is 86 Feet 4 Inches 8 Parts, and the twelfth Part of 259 Feet 2 Inches, is 21 Feet 7 Inches 2 Parts (or because 1 is the fourth Part of 4) you may more readily take the fourth Part of 86 Feet, 4 Inches 8 Parts) which is also 21 Feet, 7 Inches, 2 Parts; then add all together, and the Sum will be 12677 Feet, 6 Inches and 10 Parts.

To multiply Feet, Inches and Parts.

Example 1. Multiply 7 Feet 5 Inches, 9 Parts, by 3 Feet, 5 Inches, 3 Parts.

In this Example I first begin with 3 Feet, and there multiply 7 Feet, 5 Inches, 9 Parts; first I say, 3 times 9 is 27 Parts, that is 2 Inches and 3 Parts; set down 3 under th Parts, and carry 2, saying times 5 is 15, and 2 I carry, 17, that is 1 Foot 5 Inches set down 5 Inches and carry and say 3 times 7 is 21, and I carry is 22; set down 22 Feet

F.	I.	P.	S.	
7	5	9		
3	5	3		
22	5	3		
3	1	4	9	
	1	10	5	
25	8	6	2	

Then begin with 5 Inches saying, 5 times 9 is 45, which is 45 Seconds, which make Parts and 9 Seconds; set down 9 Seconds a Place towards the right Hand, and carry 3 Parts saying 5 times 5 is 25, and 3 carry is 28, which is 2 Inches and 4 Parts; set down 4 Parts and carry 2, saying 5 times 7 is 35, and 2 I carry is 37, which is 3 Feet and 1 Inch; set down the 3 Parts and 1 Inch, and begin to multiply by 3 Parts saying 3 times 9 is 27 thirds that is 2 Seconds and 3 Thirds set down 3 Thirds and carry saying, 3 times 5 is 15, and 2 carry is 17, that is 1 Part and 5 Seconds; set down 5 Seconds and carry 1. Saying 3 times is 21, and 1 I carry, is 22 which is 1 Inch and 10 Parts which set down and add all up together, and the Product will be 25 Feet, 8 Inches, Parts, 2 Seconds, and 3 Thirds

You are to take Notice, that in multiplying *Feet*, *Inches* and *Parts*, &c. if *Feet* be multiply'd by *Feet*, the Product is *Feet*; and *Feet* multiply'd by Inches, the Product is *Inches*, and the twelfth Part is *Feet*; and *Parts* multiply'd by *Feet*, the Product is *Parts*, and the twelfth Part thereof is *Inches*; *Parts* multiply'd by *Inches*, the Product is *Seconds*, and the twelfth Part thereof is *Parts*; and *Parts* multiply'd by *Parts*, the Product is *Thirds*, and the twelfth Part thereof, is *Seconds*.

So that if you begin to multiply *Parts* by *Feet* in the first Row, and *Parts* by *Inches* in the second Row, and *Parts* by *Parts* in the third Row, the first Figure in every Row will stand a Place more towards the Right Hand; as is to be seen in the last Example.

Example 2. Multiply 37 Feet 7 Inches, 5 Parts, by 4 Feet, 8 Inches, 6 Parts.

F.	I.	P.		
37	7	5		
4	8	6		
150	5	8	S	
12	6	5	8	
12	6	5	8	T.
1	6	9	8	6
177	1	5	0	6

First. Multiply by 4 Feet, saying, 4 times 5 is 20, which is 1 Inch 8 Parts; set down 8 and carry 1, saying 4 times 7 is 28, and 1 I carry is 29, which is 2 Feet 5 Inches; set down 5 Inches, and carry 2, saying 4 times 7 is 28, and 2 I carried is 30; set down 0, and carry 3, and say 4 times 3 is 12, and 3 is 15; set down 15.

Then begin with 8 Inches; but because the Feet in the Multiplicand are more than 12, it will be the best Way to work for the Aliquot Parts of 8; so here work for 4 Inches, and set that down twice, 4 being the third Part of 12; therefore take the third Part of 37 Feet, 7 Inches, 5 Parts, which is 12 Feet, 6 Inches, 5 Parts, 8 Seconds: set this down twice.

Then begin with 6 Parts; but instead of multiplying, take half 37 Feet, 7 Inches, 5 Parts (because 6 is half 12) and set it a Place more to the right Hand; thus the half of 37 Feet, is 18; which I must count 18 Inches; because the Multiplier is 6 Parts; so the half of 37 Feet, 7 Inches, 5 Parts, is 1 Foot, 6 Inches, 9 Parts, 8 Seconds, 6 Thirds; which set down, and add all together, and the Sum will be 177 Feet, 1 Inch, 7 Parts, 0 Seconds 6 Thirds.

Example 3. Multiply 34 Feet 4 Inches, 7 Parts, by 36 Feet 7 Inches, 5 Parts.

F.	I.	P.		
311	4	7		
36	7	5		
1866				
933	0		S.	
103	9	6	4	
77	10	1	9	T.
8	7	9	6	4
2	1	11	4	7
12	0	0	0	0
1	0	0	0	0
	9	0	0	0
11402	2	4	11	11

In this Example, because the Feet in both the Multiplicand and Multiplier are compound Numbers; first multiply the Feet one by the other; then take the Aliquot Parts of 7 Inches, which are 4 Inches and 3, that is, a third and a fourth Part; so take the third Part of 311 Feet, 4 Inches, 7 Parts, which is 103 Feet, 9 Inches, 6 Parts, 4 Seconds, and the fourth Part is 77 Feet, 10 Inches, 1 Part, 9 Seconds; set these down one under another, the Feet under the other Feet; then the Aliquot Parts of 5 Parts, are 4 and 1, that is a third and twelfth Part; so the third Part of 311 Feet, 4 Inches, 7 Parts, is 103 Feet, 9 Inches, 6 Parts, 4 Seconds; but because the Multiplyer is Parts, it must be set a Place to the right Hand; that is, the 103 must be Inches, which is 8 Feet 7 Inches; therefore I take a fourth Part of 8 Feet 7 Inches; therefore I set down 8 Feet, 7 Inches, 9 Parts, 6 Seconds, 4 Thirds.

Then because 1 Inch is a fourth Part of 4 Inches, therefore take a fourth Part of 8 Feet, 7 Inches, 9 Parts, 6 Seconds, 4 Thirds; which is 2 Feet, 1 Inch, 11 Parts, 4 Seconds, 7 Thirds, which is the same as if you had taken a twelfth Part of 311 Feet, 4 Inches 7 Parts.

Then for 4 Inches in the Multiplicand, instead of multiplying 36 Feet by it, take a third Part, because 4 inches is a third Part of 12; so the third Part of 36, is 12 Feet, and the Aliquot Parts of 7 Parts, are 4 and 3, that is a fourth and a third; so the third Part of 36 is 12, which now is 12 Inches, that is 1 Foot, and the fourth Part is 9 Inches; add all these together, and the Sum will be 1146.2 Feet, 2 Inches, 4 Parts, 11 Seconds, 11 Thirds.

Example 4. Multiply 8 Feet 4 Inches, 3 Parts, 5 Seconds, 6 Thirds, by 3 Feet, 3 Inches, 7 Parts, 8 Seconds, 2 Thirds.

F.	I.	P.	S.	T				
8	4	3	5	6				
3	3	7	8	2				
25	0	10	4	6				
2	1	0	10	4	6			
	4	10	6	0	2	6		
		5	6	10	3	8	0	
			1	4	8	6	11	0
27	7	3	5	1	8	8	11	0

MUNIONS [in *Architecture*] are the ſhort, upright Poſts or Bars, which divide the ſeveral Lights in a Window Frame.

MURING is the Walling, or the raiſing of the Walls of a Building.

MUTILATION, is a Term apply'd to Statues and Buildings, where any Part is wanting, or the Projecture of any Member is broke off.

MUTULE [in *Architecture*] is a kind of ſquare Modillion, ſet under the Cornice of the *Doric* Order, and ſo call'd from the Latin Word *Mutulus*, maimed, or imperfect, becauſe they repreſent the Ends of Rafters which are crooked or bent, in like Manner as the Beams or Joints are repreſented by the Triglyphs in the Freeze of the ſame Order.

The only Difference between *Mutule* and *Modillion*, conſiſts in this, that the former is us'd in ſpeaking of the *Doriek* Order, and the latter in that of the *Corinthian*.

MUTULES, M. *Le Clerc* makes *Mutules* in the Entablement of the *Doric* Order, to diſtinguiſh it the more from other Entablements; but alſo becauſe they agree very well with the nobleneſs of this Order, and add Something of a Maſculine Beauty to it.

Thoſe who uſe *Mutules*, uſually make them of the ſame Breadth with the Triglyphs, but he thinks it would be much better, if they were made of the ſame Breadth with the Capitals of the Triglyphs.

Nor does he run his *Mutules* ſo near the Extremity of the Larmier or Drip, as is uſually done; but that he leaves a Space of three or four Minutes between the two, that the Profile may appear the more diſtinctly, and he obſerves the ſame Rule in the *Modillions*.

N.

NAILS [in *Building* &c.] are ſmall metalline Members, ſerving to bind or faſten the Parts together.

The ſeveral kinds of Nails are very numerous.

1. *Back* and *bottom Nails*; which are made with flat Shanks to hold faſt, and not open the Wood, being proper for nailing of Boards together for Coolers, for Guts to ſave Water under the Eves of a Houſe, or for any Liquid Veſſels made of Planks or Boards.

2. *Clamp-Nails*; thoſe proper to faſten the Clamps in Buildings, &c. and repairing of Ships.

3. *Claſp-Nails*; whoſe Heads claſping and ſticking into the Wood, render the Work ſmooth, ſo as to admit a Plane over it, they are of two Kinds, *viz. long*, proper for fine Buildings of Fir and other ſoft Wood, and *ſtrong*, fit for Oak, and other hard Wood; the Sizes are 7, 7½, 8, 10, 13, 15, 18, 21, 22, 23, 28, 32, 36, and 40 *l. per* Thouſand.

Of the *Strong*, the Sizes are 15, 18, 28, 32, 40 *l. per* Thouſand.

4. Clench

4. *Clench Nails* are those commonly us'd by Boat, Lighter- and Barge-Builders, with *Boves*, and often without, they are proper for any boarded Buildings that are to be taken, because they will drive without splitting the Wood, and draw without breaking; or admit of punching out, if rightly made. The Sorts are too many to be here enumerated; for fine Work they are made with *Clasp-Heads*.

5. *Clout-Nails*, these are ordinarily us'd for nailing on of Clouts to Axle-Trees, but are proper to fasten any Iron to Wood; and if made as they should be, the Heads will hold driving home, without flying.

The Sizes are $4\frac{1}{2}$, 7, 8, 9, 12 and 15 *l. per* 1000.

6. *Deck-Nails*, those are proper for fastening of Decks in Ships, doubbling of Shipping, and Floors laid with Planks: They are of two Sorts, *Dye-headed*, and *Clasp-headed*.

The Sizes are 4, $4\frac{1}{2}$, 5, $5\frac{1}{4}$, 6, $6\frac{1}{2}$, 7, 8, and 9 Inches long.

7. *Dog-Nails*; proper for fastening Hinges on Doors, *&c*, if rightly made, they will hold the Hinge close, without the Heads flying off, or without the Help of Botching, by putting Leather between the Head and the Hinge.

The Sizes are 9, 12, 20, 25, 30, 40, 60, 80 and 120 *l. per* Thousand.

8. *Flat-Points*; are of two Kinds, *viz. Longs*, much us'd in Shipping, and are very proper where there is Occasion to draw and hold fast, where there is no Conveniency to clench.

The Sizes are $7\frac{1}{2}$, 8, 9, 10, 11, 12, 13, 14, 16, 18, 21, 22, 23, 26, 40, 55, 75, and 110 *l. per* Thousand.

The *Short*, these are fortified with Points to drive into Oak or other hard Wood, and are often us'd to draw the Sheating Boards to, very proper where Oak or other hard Wood is us'd.

The Sizes are 5, 9, 18, 26, 32, 40, 55, 75, and 110 *l. per* Thousand.

9. *Jobent Nails*; these are commonly us'd to nail thin Plates of Iron to Wood; and to nail on small Hinges for Cupboard-Doors, *&c.*

The Sizes are 2 and 3 *l. per* Thousand.

10. *Lead Nails*; are us'd in nailing Lead, Leather and Canvas to hard Wood.

The Sizes are $4\frac{1}{2}$, 7, and 8 *l. per* Thousand.

11. *Port Nails*; these are commonly us'd in nailing of Hinges to the Ports of Ships.

These Nails ought to be made strong, because they will not admit of being clenched, without prejudicing the Lining; and therefore you must take Care to demand them of a just Length, that they may come near through (so as to take sufficient Hold) and yet not so long as to come quite through.

The Sizes are $2\frac{1}{2}$, 3, 4 and 5 Inches long.

12. *Pound Nails*; these are four square in the Shank, much us'd in *Norfolk*, *Suffolk*, and *Essex*,

ſſex, tho' ſcarce elſewhere; cept for Paleing.

The Sizes are, 6*d.* 8*d.* 10*d.* *d.* and 40*d.*

13. *Ribbing Nails*; us'd for ſtening the Ribbing, to keep e Ribs of Ships in their lace in Building.

Theſe Nails, if they are ghtly made, will hold faſt and raw eaſy, without injuring the ibbing or Timbers: They e alſo very uſeful for faſten- g of Timbers that are to be s'd for a while and taken own again for further Service.

The Sizes are 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, , $7\frac{1}{2}$, 8, $8\frac{1}{2}$, and 9 Inches ong.

14. *Roſe Nails*; theſe Nails e drawn four Square on the hank, and commonly in a ound Tool, as all common 2*d.* ails are, and moſt commonly *d.* and 4*d.*

In ſome Countries they make ll their larger Sorts of Nails this Shape; but their being quare drowneth the Iron, and e Nails do not ſhew ſo fair the Eye, as thoſe that are id upon the flat, but they are ery ſerviceable if made of ugh Iron.

The Sizes are $1\frac{3}{4}$, 2, $2\frac{1}{2}$, $2\frac{3}{4}$, , $3\frac{1}{2}$, $3\frac{3}{4}$, 4, $4\frac{1}{4}$, $4\frac{3}{4}$, 5, 9, 0, 13, 14, 16, 17, 18, 24, 6, 28, 30, 32, 36 and 40 *l.* *er* Thouſand.

15. *Rother Nails* are chiefly s'd in faſtening Rother Irons Ships, theſe Nails require full Head, and to be made as to hold faſt in the Wood the greateſt Degree, with- ut clenching.

16. *Round-head Nails*; theſe are very proper to faſten on Hinges, or for any other Uſe where a neat Head is requir'd; and if they are made of the beſt tough Iron as they ought to be, are very uſeful.

The Sorts are Tacks, 2*d.* 3*d.* 4*d.* 5*d.* 6*d.* and 8*d.*

The ſame are tinn'd for Coffin Handles and fine Hinges.

17. *Scupper Nails*, are much us'd in faſtening Leather and Canvas to Wood, and therefore require a broad Head, that neither may work looſe.

The Sizes are $4\frac{1}{4}$ 7 and 8 *l.* *per* Thouſand.

18. *Sharp Nails* are much us'd, eſpecially in the *Weſt-Indies*, they are made with ſharp Points and flat Shanks, and is a very proper Nail for ordinary Uſes where ſoft Wood is uſed.

The Sizes are $2\frac{1}{2}$, $2\frac{3}{4}$, 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, $7\frac{1}{2}$, 8, 9, 10, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 33, 28, 32, 36, 40, 55, and 75 *l.* *per* Thouſand.

19. *Sheathing Nails*; theſe are commonly us'd in faſtening Sheathing Boards to Ships: The Rule for uſing them is to have the Nails full three times as long as the Sheathing Board is thick; provided the Plank be of a ſufficient Thickneſs, which ought to be enquired into; for the Sheathing Nail ought not to go through the Plank by half an Inch, leſt it ſhould make the Ship leaky.

The Shank muſt not be ſo ſtrong as to cleave the Board, and the Head muſt be well claſped or died, ſo as it may ſink into the Wood, and the Ships Side be left ſmooth.

They

They are alſo a uſeful Nail in doubling of ſmall Ships.

The Sizes are, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{3}{4}$, $3\frac{1}{4}$ and $3\frac{1}{2}$ Inches long.

20. *Square Nails*; theſe are of the ſame Shape as Sharp Nails, and a moſt uſeful Nail for Oak and other hard Woods, as alſo for nailing up Wall Fruit, the Points being made ſomething ſtronger than the Points of Sharp Nails, which fortifies them to go forward, and not turn back upon a ſmall Oppoſition, as weaker Points will do.

The Sizes are $2\frac{1}{2}$, $2\frac{3}{4}$, 3, 4, $4\frac{1}{2}$, 5, $5\frac{1}{2}$, 6, $6\frac{1}{2}$, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 22, 23, 24, 28, 30, 32, 36, 40, 55, and 75 *l. per* Thouſand.

21. *Tacks*; the ſmalleſt of Nails, are to faſten Paper to Wood; *middling*, for Wool, Cards and Oars, and the *larger* for Upholſters and Pumps.

The Sizes are $2\frac{1}{4}$, 5, 6, 8, 9, 14 and 15 Ounces *per* Thouſand.

Allowance in Lathing]. 500 Nails are ordinarily allow'd to Bundle of five Foot Laths, and 600 to a Bundle of four Foot Laths; at ſix Score Nails to the Hundred.

Allowance in Flooring]. In laying of Floors, 200 (that is 240) is a ſufficient Allowance for a Square of Flooring.

Nails are ſaid to be toughened when too brittle, by heating them in a Fire-Shovel or the like, and putting ſome Tallow or Greaſe among them.

NAKED [in *Architecture*] as the *Naked of a Wall*, &c. is the Surface or Plain fr whence the Projectures ari or which ſerves as a Ground the Projectures.

NAVE [in *Architectur* the Body of a Church, or t Place where the People a diſpos'd; reaching from t Rail or Balluſter of the Cho to the chief Door: Some d rive it of *Naus i. e.* a Ship, b it ſeems more properly to co from Ναὸς Gr. *Naos* a Temp

NEWEL [in *Architectur* is the upright Poſt which Pair of winding Stairs tu about; or that Part of a Sta Caſe which ſuſtains the Steps.

The Newel is a Cylinder Wood or Stone, which bears the Ground, and is form'd b the Ends of the Steps of th winding Stairs.

There are alſo Newels Wood, which are Pieces Wood plac'd perpendicularly receiving the Tenants of th Steps of the wooden Stairs in their Mortices; and wherei are fitted the Shafts and Ref of the Stair Caſe, and th Flights of each Story.

NICHES are Hollows ſun into the Wall, for the commo dious and agreeable placing Statues.

Their ordinary Proportion to have two Circles in Heigh and one in width; but M. *Clerc* makes their Height ſome thing more, the Exceſs bein to compenſate for the Heigh of the Plinth or Pedeſtal of th Statue.

The Hollow is Semi-Circu lar at Bottom, that is, in i Plan; at Top it terminates

kind of Canopy, or *Cul de* *r.*

Niches have frequently an poſt, and an Archivolte or ead Band, and their Canopy ought and inrich'd in man- r of a Shell.

The Breadth of the Archi- lte may be made equal to a th or ſeventh Part of the che, and the Height of the poſt to be a fifth or ſixth rt of the ſame.

The Impoſt and Archivolt ght to conſiſt of ſuch Mould- s as have ſome Relation to Architecture of the Place.

When a *Niche* is placed un- neath an Impoſt, between o Columns or Pilaſters, it ould have no Impoſt of its n; for two Impoſts over each er, would have a woful Ef- t; beſides that the Pede- ls in this Caſe, having their ſes and Corniſhes, there uld be too many Mouldings r one another.

There muſt no Niche be de between two Pilaſters, if y are not a-part nearly one rd of their Height; other- e we ſhould have Niches ſcanty and narrow. Care ſt alſo be taken, that they not too big; leſt by that ans the Architecture be de to appear little and piti- : Thus, for Inſtance from largeneſs of the Niche one ed to judge that the Archi- ure is only intended for a appel or other Building of ordinary Size.

Niches ſhould be plac'd at Height of the Pedeſtal of Columns or Pilaſters that occompany them.

When Niches are plac'd un- derneath Impoſts, the opening of the Arches ſhould be ſome- what narrower than ordinary, that the Impoſts being on that Account a little higher, the Niches may become of a mo- derate Bigneſs: For this Rea- ſon, inſtead of 12 Modillions between the Pilaſters, M. *Le Clerc* ſays, I only make 11, that is, I retrench one Modillion from the Corniche, that the Pilaſters may approach each other equally.

When the Columns have no Pedeſtals, a Niche may be rais'd higher than their Baſe; and in that Caſe, a Table or Pannel may be plac'd under- neath.

If it happen that a Niche with an Impoſt be plac'd be- tween two Pilaſters, without any Portico, it ſhould be made with a Retreat or Fall back- wards, to prevent the Neceſſity of continuing its Impoſt between the Pilaſters. For that Impoſt being proportioned to the Niche, cannot be in Proportion to the Pilaſters. Beſides, without this Expedient, I don't readily ſee how it could be well terminat- ed on the Side of the Gate.

There are ſometimes Niches made ſquare, but theſe want all the Beauty of the others.

If the Order of the Column or Pilaſter ſhould be too big and high, the Niche would be- come too large and unſizeable, the Pilaſters muſt be brought to a Modillion or two nearer each other, and inſtead of a Niche with a Retreat, a Niche

 may

may be made with a *Chambranle*, and a Corniche crown'd with a Pediment, over which may be an oval Light of the ſame width with the Niche.

A *Round Niche* is one whoſe Plan and Circumference is circular.

Square Niche is one where they are ſquare.

Angular Niche, one that is form'd in the Corner of a Building.

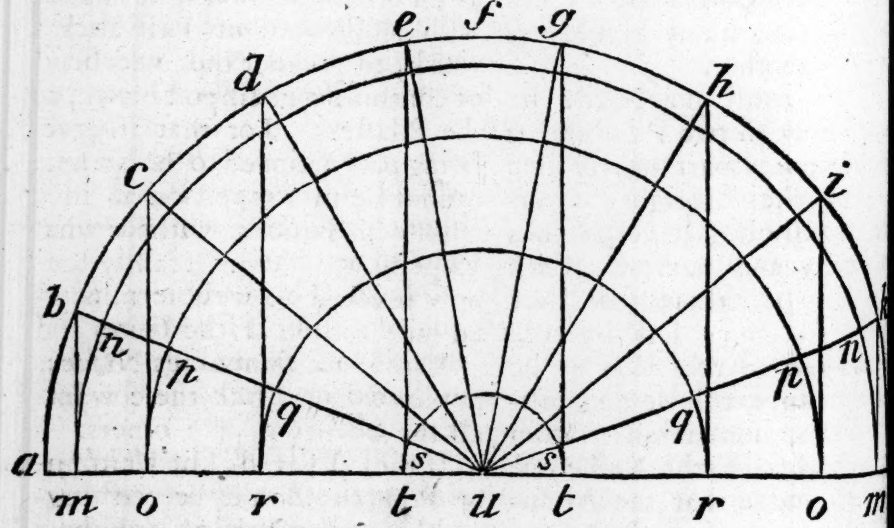
Ground Niche, is one which inſtead of bearing on a maſſive, has its Riſe from the Ground, as the Niches of the Portico of the *Pantheon* at *Rome*.

Niches are ſometimes made with Ruſtick Work, ſometimes with Shell Work, and ſometimes of Cradle or Arbour Work.

If the Images be of white Stone or Marble, let not the Concavities be coloured t black, becauſe 'tis an Obſerv tion that the Sight is not we pleas'd with ſudden Chang from one Extreme to another therefore let them have rathe a duſtich Tincture, than an ab ſolute black.

To make a Niche *or* Glob *with thin Boards, or to cove them with Paper or Paſ Board.*

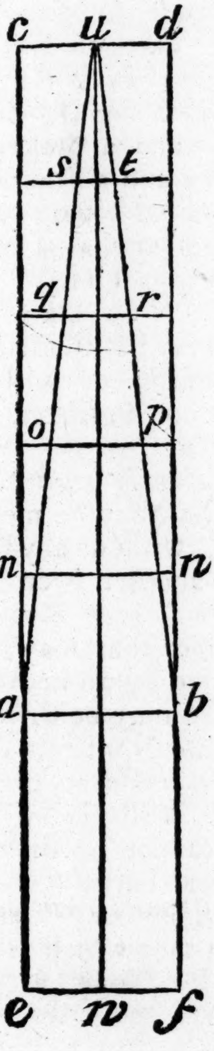
The Arch *a*, *f*, *l*, is a Semi Circle, and the Plan of a *Niche*, and is divided into nin equal Parts mark'd, *a b*, *b c d*, *d e*, *e g*, *g h*, *h i*, *i* and *k l*; which repreſents th wideſt Part of the Board, Paper or Paſt-Board; and the Figure repreſents its Shape an the Curve of the Edges befor it is bent to its Work.



To do this, draw the Baſe Line *a l*, to which ſtrike the Semi-Circle *a f l* (and let *a e*, and *f l*. be equal) and divide it into ſo many Parts as you d ſign the width of Board or P per in the Quarter of the *Glo* or *Niche*, as in the Exampl

Ma

ark, *a b c d e f g h i k l*, d draw the Lines, *b u*, *c u*, *u*, *e u*, *f u*, *g u*, *h u*, *i u*, d *k u*; alſo the Lines *m b*, *c*, *r d*, *t e*, *t g*, *r h*, *o i*, d *m k*, perpendicular to the ine *a l*; and ſtrike the Semi-rcles *m m*, *o o*, *r r*, and *t t*, Then with a thin Lath, or Arithmetick take the Length the Arch or Quadrant *a f*, *l f*, and ſet it on the Board Paper from *c d*, to *a b*, in e Second of theſe Figures, hich you muſt divide into ſo



many equal Part as there are Semi-Circles in the firſt Figure, which in this Example is 5, and draw the Lines, *c d*, *t s*, *r q*, *o p*, *m n*, and *a b* and divide them in the middle by the Line *u w*:

Then take half the Arch of the *a b* in the firſt Figure in your Compaſſes, and ſet it both Ways from the middle Line *u w* in the ſecond Figure to *a* and *b*; alſo take half the Circles *m n*, *o p*, *r q*, and *t s*, in the firſt Figure, and ſet them on their reſpective Lines on Figure 2, as in the Margin, from the middle Line *u w*, to *m* and *n*, *o* and *p*, *r* and *q*, *t* and *s*. then will the Arch *a b*, be equal to the Right Line *a b*; the Arch *m n*, to the Right Line *m n*; alſo *o p* to *o p*, *r q*, to *r q*, *t s*, to *t s*, and the Point *u* to the Point *u*: The Points *a*, *m*, *o*, *q*, *s*, *u*, *t*, *r*, *p*, *n*, *b*, being found, into each ſtick a a Pin or ſmall Nail, and bend a thin Lath to them, by the Edge of which draw the Curves *a u*, and *b u*, which is the true Mould for every Piece in a Niche or Globe; which is what was to be done.

N. B. This Problem is equally as uſeful for Maſons and Bricklayers in making Niches in Stone or Brick, as for Joiners, &c.

NOTATION [in *Arithmetick*] is the Art of characterizing Numbers, or of deſigning them by proper Figures, the Choice of arithmetical Characters is arbitrary: Hence they are various in various Nations. But perhaps there are none ſo

commodious, as thoſe commonly us'd in *Europe*, which are commonly ſaid to have been invented by the *Arabs*, and thence call'd *Arabick* Characters.

NUCLEUS [in *Architecture*] is the middle Part of the Flooring of the Ancients; conſiſting of Cement, which they put betwixt a Lay or Bed of Pebbles, cemented with Mortar made of Lime and Sand.

NUMBER [in *Arithmetick*] a Collection or Aſſemblage of ſeveral Unites.

Stevinus chuſes to define Number to be that whereby the Quantity of any Thing is expreſs'd. Agreable to which Sir *Iſaac Newton* conceives Number to conſiſt, not in multitude of Unites, as *Euclid* defines it; but in the abſtract Ratio of a Quantity of any Kind, to another Quantity of the ſame Kind, which is accounted as Unity; and on this View he divides Numbers into 3 Kinds, *viz. Integers*, *Fractions* and *Surds*.

Mathematicians conſidering Number under a great many Circumſtances; different Relations and Accidents make many Kinds of Numbers.

A *determinate* NUMBER, is a Number referr'd to ſome given Unite; as a Ternary or 3, which is what we properly call a Number.

An *indeterminate* NUMBER, that referr'd to Unity in the General, which iswhat we call Unity.

Homogeneal NUMBERS, are thoſe referr'd to the ſame Unite.

Heterogeneal NUMBERS ar[e] thoſe referr'd to different One[s]

Whole NUMBERS, or *Integers*, are the Aſſemblages o[f] *Unity*, or the Idea we have of Multitude.

Broken NUMBERS or *Fractions*, are thoſe which conſiſt o[f] ſeveral Parts of Unity.

Rational NUMBER, is on[e] that is commenſurable wit[h] Unity.

Rational whole NUMBER, [is] that whereof Unity is an Aliquot Part.

Rational broken NUMBER, [is] that equal to ſome Aliquo[t] Part, or Parts of Unity.

Rational mix'd NUMBER, [is] that which conſiſts of a whol[e] *Number* and a broken one, o[r] of Unity and a Fraction.

Irrational NUMBER or *Sur[d]* is a Number that is incommenſurable with Unity.

Even NUMBER, is tha[t] which may be divided into tw[o] equal Parts, or without Remainder or Fraction, as 4, 6, 8, 10, &c.

An *Evenly even* NUMBER is one that may be meaſured o[r] divided, without any Remainder, by another even Number

Unevenly even NUMBER, [is] a Number that may be equally divided by an uneven Number, as 20 may be divided by [5.]

Uneven NUMBER, is tha[t] which exceeds an even Number, at leaſt by Unity, o[r] which cannot be divided in[to] two equal Parts.

Primitive or *Prime* NUMBER, is that which is only diviſible by Unity, as 5, 7, 1[1,] &c.

Pri[me]

Prime NUMBERS *among themselves*, are those which ave no common Measure, as 2 and 19.

Compound NUMBER, is one hat is divisible by some other umber besides Unity, as 8 is ivisible by 4 and by 2.

Compound NUMBERS *among hemselves*, those which have me common Measure besides nity, as 12 and 15.

Perfect NUMBER, is that hose Aliquot Parts added to- ether, make the whole Num- er, as 6, 28, &c. the Aliquot art of 6, being, 3, 2, and 1, = 6, and those of 28, being , 7, 4, 2, 1, which together ake 28.

Imperfect NUMBERS, are ose whose Aliquot Parts ad- d together, make either ore or less than the whole of hich they are Parts.

Imperfect Numbers are di- nguish'd into *abundant* and *fective*.

Abundant NUMBERS, are ose whose Aliquot Parts, ake more than the Number which they are Parts, as 12, ose Aliquot Parts, 8, 4, 2 d 1, makes *16*.

Defective NUMBERS, are se whose Aliquot Parts ad- d together, make less than Number whose Parts they ; as *16*, whose Aliquot ts are 8, 4, 2 and 1 only ke 15.

Plane NUMBER, is one that es from the Multiplication two Numbers; *ex. gr. 6* ich is the Product of 3 mul- y'd by 2; the Numbers ich are thus multiply'd pro- duce a *plane Number*, as here 2 and 6 are call'd the Sides of the *Plane*.

Square NUMBER, is the Product of any Number multi- ply'd by it self; Thus 4 the *Factum* of 2 by 2 is a square Number.

Every square Number added to its Root, makes an even Number.

Cubick NUMBER, is the Pro- duct of a *Square Number* mul- tiply'd by its Root, *ex. gr.* 8 the Product of the Square Number 4, multiply'd by its Root 2.

Polygonous NUMBERS are the Sums of Arithmetical Progressions, beginning with Unity.

These where the Difference of Terms is 1. are call'd *Tri- angular Numbers*; where 2, *Square Numbers*; where 3, *Pentagonal Numbers*; where 4, *Hexagonal Numbers*; where 5, *Heptagonal Numbers*, &c.

Pyramidal NUMBERS, the Sums of *Polygonous Numbers*, collected after the same Man- ner as the *Polygons* themselves, are gathered out of Arithmeti- cal Progressions, and are call'd *first Pyramidal Numbers*.

The Sums of the *first Py- ramidals* are call'd *second Py- ramidals*, the Sums of the *Se- cond Pyramidals* are call'd *Third Pyramidals*.

In particular they are call'd *Triangular Pyramidal Num- bers*, if they arise out of Tri- angular Numbers *First Penta- gonal Numbers*, if they arise out of *Pentagons*, &c.

Cardinal NUMBERS are

those which express the Quantity of Unites as 1. 2. *&c.*

Ordinal Numbers, are those which express the Order or Rank, as 1*st*, 2*d*, 3*d*, *&c.*

NUMERATION, [in *Arithmetick*] the Art of valuing pronouncing, or reading any Number, or Series of Numbers.

The Characters by which Numbers are usually express'd, are the nine following ones, *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9. It being the Law of the common *Numeration*, that when you are arriv'd at ten, you begin again and repeat as before, only expressing the Number of tens.

That the nine numerical Notes may express not only Units, but also Tens or Decades, Hundreds or Centuries, Thousands, *&c.* They have a Local Value given them, so as that when either alone, or when plac'd in the Right Hand Place, they denote Units; in the second Place Tens; in the third Place, Hundreds, in the fourth, Thousands, *&c.*

NUMERATOR *of a Fraction*, is that Part of it which shews or numbers how many of those Parts which any Integer is suppos'd to be divided into, are express'd by the Fraction.

Thus in $\frac{6}{8}$ 6 is the Numerator (which stands always above the Line) and shews you, that if any whole be divided into eight Parts, you number and enumerate or take six of them, *i. e.* three Quarters.

O.

OAK, a Sort of Timbe[r] well known. It is one o[f] the principal Materials in Building, being strong in all Positions, and may well be trusted in cross and transverse Work; as for Summers and Girding, or binding Beams, *&c.*

Of sawing Oak.] It is worth sawing 2*s.* 8*d.* *per* Hundred, 3*s.* and upwards to 3*s.* 6*d.* *per* Hundred, that is, a hundred superficial Feet.

OBELISK is a Quadrangular Pyramid, very high and slender, rais'd as an Ornament in some publick Place to shew the largeness of some Stone of an enormous Size, or to serve as a Monument of some memorable Transaction, and frequently charg'd with Inscriptions and Hieroglyphicks.

Some make this Distinction between *Obelisks* and *Pyramids*; that an *Obelisk* has a very small Base, and a *Pyramid* a large one.

Cardan makes the Difference to consist in this, that an *Obelisk* is to be all of a Piece, or consist of a single Stone and *Pyramids* of several.

The Proportions in the Height and Thickness, are nearly the same in all *Obelisks*; that is, their Height is nine or nine and a half, and sometimes ten times their Thickness, and their Thickness or Diameter at the Top is never less than half, and never greater than three fourth of that at the Bottom.

It appears that this Kind of onument was very ancient, d some say, they were first 'd for transmitting to Posteri- the principal Precepts of ilosophy, which were engra- n on them in Hieroglyphical aracters. The first *Obelisk*, istory gives us Account of, s rais'd by *Ramises* King of *gypt*, in the Time of the ojan War. It was 40 Cubits Height, and as *Herodotus* re- es, employ'd 20000 Men in Building.

Another of 45 high, was 'd by *Phius* another King *Egypt*, and another of 88 bits, was erected in Memo- of *Arsinoe*, by *Ptolemy Phi- elphus*.

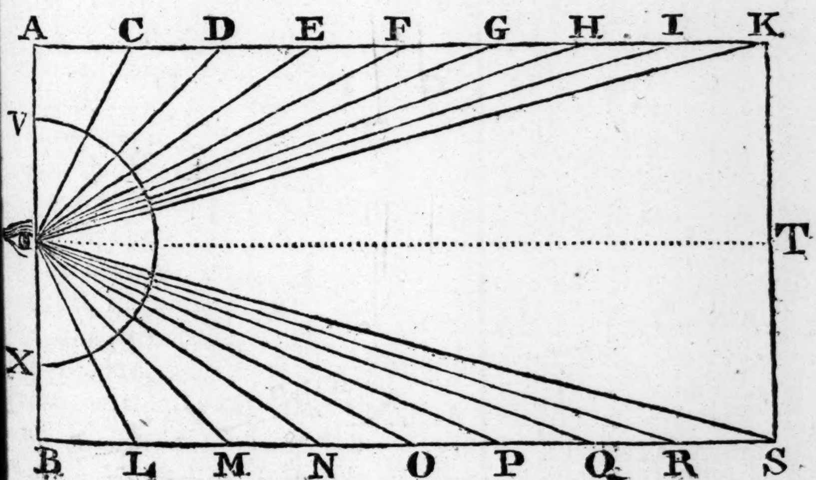
There was an *Obelisk* erect- the *Campus Martius* at *me* by *Augustus Cæsar*, which 'd to mark the Hours on a izontal Dial, drawn on the ement.

. *Kircher* reckons up 14 *lisks* that were celebrated ve the Rest, *viz.* that of *Alexandria*; that of the *Barberins*; those of *Constantinople*; of the *Mons Esquilinus*; of the *Campus Flaminius*; of *Florence*; of *Heliopolis*; of *Ludovisco*; of S. *Makut*; of the *Medici*, of the *Vatican*: of M. *Cælius*, and that of *Pamphila*.

Obelisks were called the Sun's Fingers by the *Egyptian Priests*, because they were made to serve as *Styles*, or Gnomons to mark the Hours on the Ground. The *Arabs* still call them *Pharaoh's Needles*, whence the *Italians* call them *Aguglia*, and the *French Aiguillies*.

OBJECTS [in *Perspective*] It is shewn by the following Figure why Objects appear the nearer each other, as they are more remote from the Eye.

Suppose a Spectators Eye in the middle of a Line at + it is evident, that if it would see the two Extremes thereof, A and B, it must take in a Semi-Circle V X, whose Centre is in the Eye it self, and whose central Ray, is the Line +T.



By taking in this Semi-Circle, it will receive the Objects on either Side, and in ſuch Manner, as that thoſe furtheſt off from the Side A, appear to approach towards the Centre T, and thoſe on the Side B, ſeem to approach likewiſe.

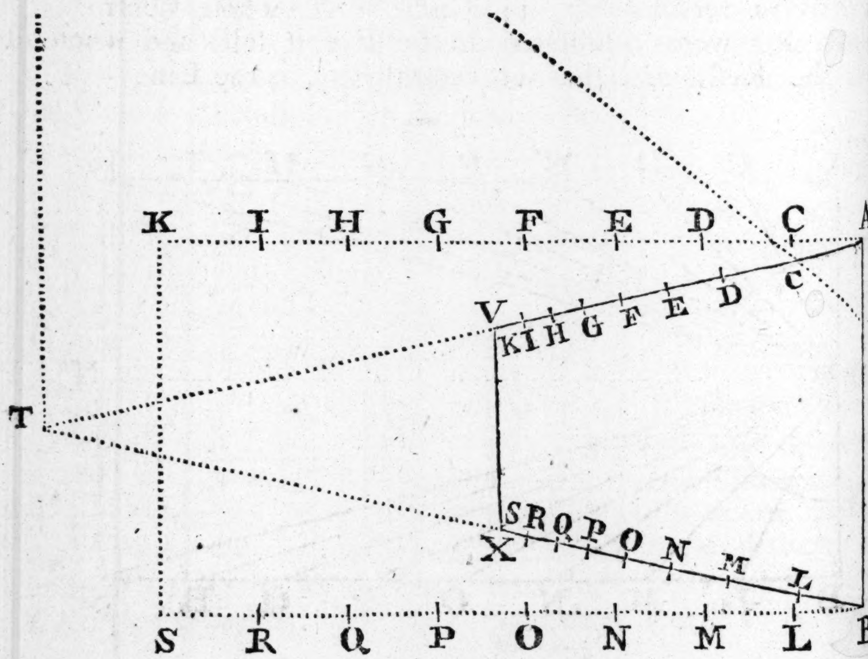
Now if it be ask'd, How Things ſo wide aſunder, ſhould come to approach and join each other, and that, whether ſituated Side-wiſe, or over one another?

The Anſwer in few Words, is this: All Objects appear under the viſual Angle, they ſubtend at the Eye. Now be they Columns, Trees, Animals or any other Things, plac'd on the Side of A, the Remoteſt will ſeem to border on the Centre T, by Reaſon that they are ſeen under an Angle or Ray that is near thereto.

The Ray + K for Inſtance, being much nearer the Central Ray T, than is the Ray + C and + E, and of Conſequen[ce] muſt appear to be there: Ad[d] that if the Objects were pro[-]longed to Infinity, they woul[d] ſtill approach nearer to th[e] Central Ray T. till ſuch Tim[e] as they ſeem contiguous there[-]with, and only to form o[ne] Point together.

Now in Perſpective, the Sid[es] A K and B S don't contin[ue] parallel, but degenerate in[to] viſual Rays, interſecting eac[h] other in the Point of Sight, an[d] by that means giving the Di[-]minution of Objects.

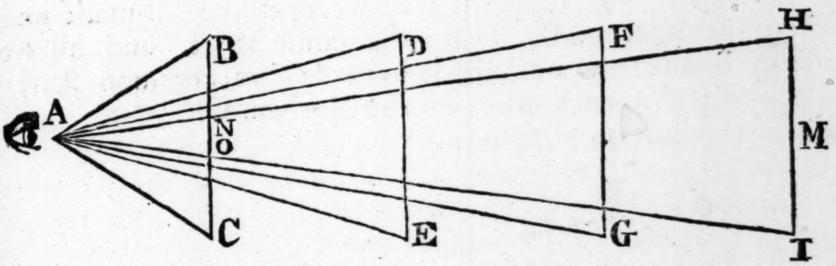
Thus for Inſtance, in th[e] Figure, the Eye being at a Di[-]ſtance capable of ſeeing th[e] Line A B, from the two Angl[es] A B ariſe two Rays, whic[h] proceed to the Point of Sig[ht] T, which Rays A T and B T receive the Interſections, th[e] Point of Diſtance makes wit[h] the Objects, which all th[e]



hile contract themſelves pro-ortionably. By ſuch Means, he whole Parallelogram A K S, and all the Objects on ei-her Side become reduc'd into he narrow Compaſs A V B X; nd if the Eye were more re-mote, that Space would be ſtill maller; ſince the farther an bject is off, the ſmaller it ap-ears, as will appear by the ollowing Figure.

The Reaſon why Objects appear the ſmaller, as they are at the greater Diſtance.

It has been ſhewn before that Things appear according to the Angle wherein they are ſeen, and that this Angle is taken at the Eye, where the Lines terminating the Objects meet.



The Eye A for Inſtance, viewing the Object B C, will draw the Rays A B and A C, which give the Angle B A C; ſo that an Object view'd under a greater Angle, will appear large, and another under a leſ-ſer Angle, little.

Now 'tis certain, that among equal Objects, thoſe at the greateſt Diſtance, will appear under the ſmalleſt Angle; con-ſequently in all Perſpectives, the remoteſt Objects muſt be made the ſmalleſt.

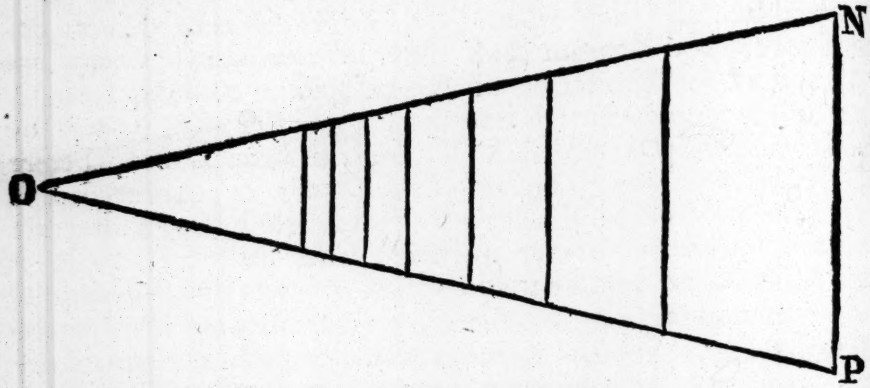
As for Example, if the Eye be in A, the Object B C, which is the neareſt, will appear the biggeſt, becauſe being ſeen un-der the greateſt Angle; and the ſecond, third fourth Ob-jects, will all appear ſmaller and ſmaller, tho' really all equal, in as much as the An-gles diminiſh in Proportion as the Objects recede.

If the Eye were remov'd in-to M K L, would appear the largeſt; and B C in this latter Caſe, no bigger than N O.

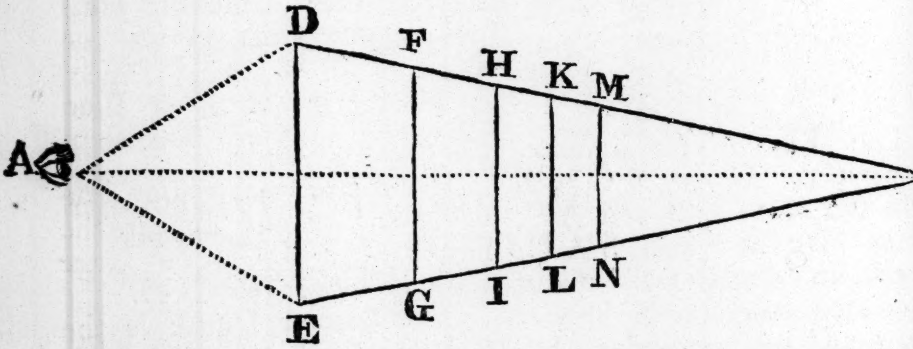
The Second Figure is the Sequel of what has been ad-vanc'd.

For ſuppoſing the Objects to appear ſuch as is the Angle they are ſeen in, it follows that if ſeveral Lines be drawn be-tween the Sides of the ſame Triangle, they will all appear equal: Thus all the Lines com-priz'd between the Sides O N O P of the Triangle N O P, will appear equal to each other; and as Objects com-prehended under the ſame An-gle, ſeem equal, ſo all com-prehended under a greater An-gle ſeem greater, and all un-der a ſmaller Angle, ſmaller.

Thus



Thus much being suppos'd; if there be a Number of Columns or Pilasters to be rang'd in Perspective on each Side of a Hall or Church, they must of Necessity be all made under the same Angle, and all tend towards one common Point in the Horizon O.

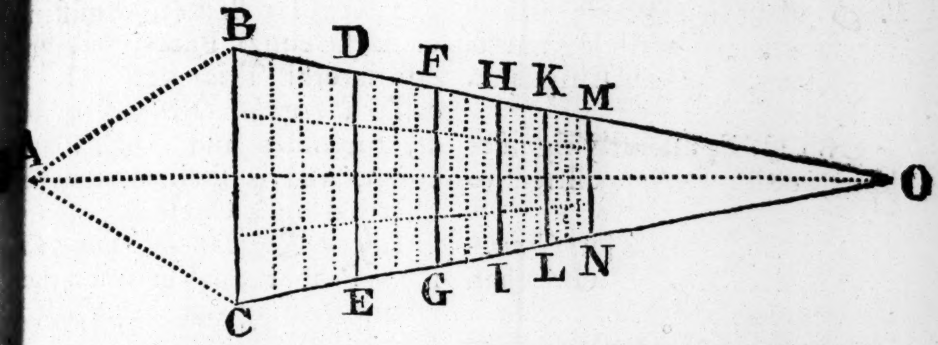


For Instance, the Eye being plac'd in A, viewing the first Object D E; if from the Points D E you draw the visual Rays D O, E O, they will make the Triangle D O E, which will include the Columns D E, F G, H I, K L, M N, so as they will all appear equal.

What has been said of the Sides is likewise to be understood of Ceilings and Pavements; the Diminutions of the Angles of remote Objects, plac'd either above or below, following the same Rule as those plac'd laterally.

Therefore there is no need of adding any thing farther; unless it be, that Care be taken that there be as many Squares or Divisions between the remotest Objects, as between the nearest: for in that Case, tho' distant Objects be the closer, as they are further from us, they will appear in some Measure to preserve their Distance; thus in B C D E, the Interval between the four nearest Columns, there are 16 Squares; and no fewer between the two most remotest K M.

It follows from what has been said, that if you join two Triangles, as in the last Figure but one



ne for the Sides, and two o-
thers of the laſt, for Tops and Bottoms of an Object, all four will terminate in one ſingle Point A, which is the Point of Sight where all viſual Rays meet; and this will demonſtrate what has been advanc'd, *viz.* that Objects diminiſh as they remove, the lower riſing, the upper falling, and the lateral cloſing or approaching: an Example of all which is given in Figure 1, which exhibits as it were, Depths and Diſtances, falling back and receeding from us, though all equally near the Eye.

Trees being rang'd by the ſame Law, have the ſame Effect as the Columns, *&c.*

For being all comprehended in the ſame Angle, and the two Rows having each its own Angle, and the Angles all meeting in the Point A, they form a third, which is the Earth and a fourth, which if you pleaſe is the Air.

OBLIQUATION [in *Catoptricks*] as the Cathetus of Obliquation is a Right Line drawn perpendicular to a Mirrour in the Point of Incidence or Reflexion of a Ray.

OBLIQUE [in *Geometry*] aſlant, Indirect, or which deviates from the Perpendicular.

OBLIQUE *Angle* [in *Geometry*] is an Angle that is either acute or obtuſe: *i. e.* any Angle, except a Right Angle.

OBLIQUE *angled Triangle*, is that whoſe Angles are oblique, *i. e.* either obtuſe or acute.

OBLIQUE *Line*, a Line falling on another, makes an oblique Angle.

OBLIQUE *Projection* [in *Mechanicks*] is that where a Body is impell'd in a Line of Direction, which makes an oblique Angle with the horizontal Line.

OBLIQUE Force [in *Mechanicks*] is that whoſe Line of Direction is not at Right Angles with the Body on whom it is impreſt. The Ratio which ſuch an *oblique Force* to move a Body bears to a direct or Perpendicular Force, will be as the Line of the Angle of Incidence is to the Radius.

OBLIQUITY is that which denominates a Thing oblique, as the Obliquity of the Sphere.

OBLONG [in *Geometry*] is the ſame with a Rectangled Parallelogram, whoſe Sides are unequal; or it is a Figure longer.

longer than it is broad; thus a Rectangle or Parallelogram is an oblong; and an Ellipſis in an Oblong.

OBTUSE, literally ſignifies blunt, dull; in Oppoſition to acute, ſharp.

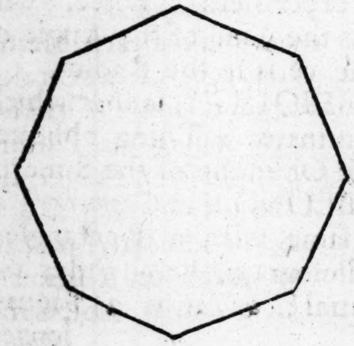
OBTUSE *Angle* [in *Geometry*] is an Angle of more than 90 Degrees, *i. e.* more than a Quadrant of a Circle; or it is an Angle greater than a Right Angle.

OBTUSE *angled Triangle* is one that hath an obtuſe Angle, as above.

OCCULT [in *Geometry*] is us'd in ſpeaking of a Line that is ſcarce perceivable, drawn with the Point of the Compaſſes or a black Lead Pencil.

Occult or dry Lines are us'd on ſeveral Operations, as the raiſing of Plans, Deſigns of Building, Pieces of Perſpective &c. they are to be effaced when the Work is finiſh'd.

OCTAGON [in *Geometry*] is a Figure of eight Sides and Angles; or it is one of the



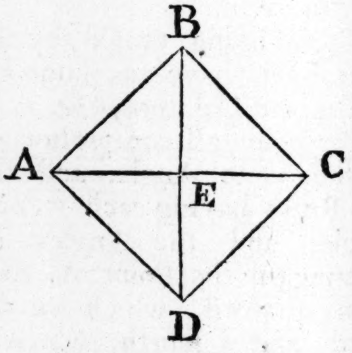
five Regular Bodies, conſiſting of eight equal Faces, or eight equilateral Triangles. It is call'd a *regular Octagon*, when all the Sides and Angles are equal, and is ſuch as may be inſcrib'd in a Circle.

Every *Regular Octagon* is a mean Proportional between the circumſcribing and the inſcrib'd Square.

OCTAHEDRON } [in *Geometry*]
OCTAEDRON } is one of the Regular Solids, conſiſting of eight equal and equilateral Triangles.

The Square of the Side of the *Octahedron* is to the Square of the Diameter of the circumſcribing Sphere, as 1 to 2 or is in a Subduple Ratio of the Diameter of the circumſcribing Sphere.

If the Diameter of the Sphere be 2. the Solidity of the *Octahedron* inſcrib'd to it, will be 1 . 33333.



Let A B C D E be an *Octahedron*, whoſe Side is 12 Inches; the Content Solid and Superficial is requir'd.

An *Octahedron* is compoſ'd of two Quadrangular Pyramids join'd together by their Baſes, as in the ſecond Figure; therefore

re if the Area of the Base be ultiply'd into a third Part of e Length of both Pyramids, e Product will be the Solid ontent.

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 5.6568
    144
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 226272
226272
56568
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814.5792
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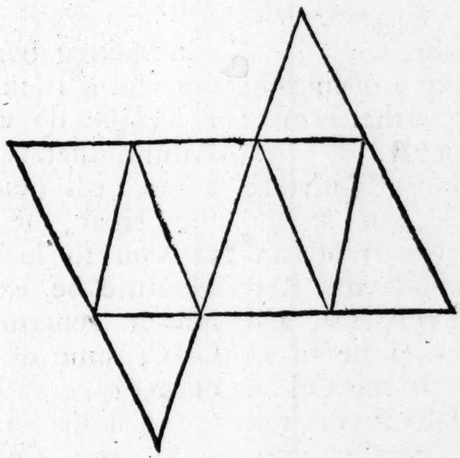
The Superficial Content will be just double to that of the *Tetrahedron, viz.* 498.816; because the Side of this is suppos'd to be equal to the Side of that; and because the *Octahedron* is contain'd under 8 Triangles and the *Tetrahedron* but under 4.

By this Figure you may cut this Body in fine Paste-board, cutting all the Lines half through. and so turn it up and glue it.



OCTOSTYLE [in *Archi-ecture*] is the Face of an Edi-ice adorn'd with 8 Columns.

OFFICES [in *Architecture*] re all the Lodges and Apart-nents, which are employ'd for he necessary Services and Oc-asions of a Palace or great House; especially those which ave Relation to Eating; as, Kitchins, Pantries, Bake-Houses, Brew-Houses, Granaries, Fru-eries, Confectionaries, Wood-Houses, Equerries, &c.

The Offices are commonly n the Basse Courts; and some-imes they are sunk under Ground, and well vaulted, &c.

OGEE, O. G, OGIVE } [in *Architecture*] is a Moulding consisting of 2 Members, the one Concave and the other Convex, or of a round and a hollow, like an S, the same with *Cymatium*.

Vitruvius makes each Member a Quadrant of a Circle. *Scammozzi* and some Others, make them somewhat flatter, and strike them from two equilateral Triangles.

OGIVE [in *Architecture*] Is us'd for an Arch or a Branch of a *Gothick* Vault, which instead

ſtead of being circular, paſſes diagonally from one Angle to another, and forms a Croſs between the other Arches, which makes the Sides of the Square, of which the Arches are Diagonals.

The middle where the *Ogives* cut or croſs each other, is call'd the Key; which is ſometimes cut in form of a Roſe, or a *Cul de Lamp*.

The Members or Mouldings of the *Ogives* are call'd Nerves, Branches, or Reins; and the Arches which ſeparate the *Ogives*, double Arches.

OIL: To make a drying Oil to make any Colour that is mixt with it, dry quickly,

Add two Ounces of Litharge of Lead (to be had at the Druggiſts) to a Quart of Linſeed Oil (tho' ſome uſe Red Lead) powdered very fine, and boil it for near an Hour in an earthen Pan, or till the Oil be grown fat, or almoſt of the Conſiſtence of Treacle, then ſet it on Fire with a lighted Paper, keep it ſtirring while burning, which need not be above a Minute or two, then put out the Flame, and let it ſtand till it be thoroughly cold, and that the Litharge has ſettled well to the Bottom; then pour off the clear Oil, and put it in a Bladder, cloſe ty'd up for Uſe.

When you mix up your Colours for working, take three Parts of plain Linſeed Oil, and one Part of this drying Oil and mixing them well together, temper up your Colours with this Mixture.

This fat drying Oil ſhall not only make the Colours dry ſooner; but will alſo add Beauty and Luſtre to the Colours.

Some Colours indeed don't need to have their Drying haſten'd by a fat Oil, as Red Lead, Verdigreaſe and Umber, they being very drying of their own Nature; but yet fat Oil added to thoſe alſo, add a great Beauty and Luſtre to their Colour.

Some Painters to make their Colour dry, take *Copperas*, and having beaten it to Powder, burn it in a Fire-Shovel, as People do when they burn Allum, that is, they ſet it on a Fire, till being melted with the Heat, it be continued thereon ſo long, till all the Moiſture be exhaled, and the Matter remain a dry white Calx; ſome of this Powder of burnt *Copperas* being added to the Colours in Grinding, will make the Colour dry very well.

There is indeed one Inconvenience in the drying Oil above-mentioned, which is, that it makes the Oil of a deep reddiſh Colour, which is apt to alter the native Beauty of ſome Colours, as Whites, making them turn Yellow, and blues become Greeniſh.

But a drying Oil may be prepar'd, which ſhall be of a clear white Colour, as follows.

Put two Ounces of Litharge to a Quart of Linſeed Oil, put the Mixture into a Glaſs, and ſet it in the hot Sun for a Month in the Summer time; ſtirring the

e Litharge and the Oil well gether twice a Week during e whole Time; and you will t fail in that time to have t only an Oil very white and ear (for the Sun takes away l Colour either from Linſeed Walnut Oil) but alſo it will come in that Time very fat d thick, and attain a very ying Quality.

By the ſame Methods may ut Oil be made to dry, as ell as that of Linſeed, it ing preferr'd before that of nſeed, for all white Painting at is not expos'd to the open ir, for 'tis obſerv'd, that in l cloſe Places, Linſeed Oil apt to make white Lead turn llow.

You muſt take Notice that ſimple Colours us'd in ouſe Painting, appear much ore beautiful and luſtrous hen they appear as if glaz'd er with a Varniſh, to which th the drying Oil mentioned fore, contributes very much, d alſo the Oil of Turpentine, at Painters uſe to make their lours dry ſoon.

But Experience has taught, at ſome good clear Turpen- e, diſſolv'd in the 'foreſaid l of Turpentine, before it mix'd with the Oil Colours, ll make thoſe Colours ſhine ch when dry, and preſerve eir Beauty beyond moſt other ings, drying with an ex- me Gloſſy Surface, more ooth than Oil alone, and ll alſo better reſiſt the Inju- s of the Air and Weather, vided too much of it be not t in.

OMPHALOPTICK [in *Opticks*] is a Glaſs that is convex uſually call'd a *Convex Lens*.

OPPOSITION [in *Geometry*] is the Relation of two Things between which a Line may be drawn Perpendicular.

OPTICKS is properly the Science of direct Viſion; tho' the Word is ſometimes us'd in a larger Senſe, for the Science of Viſion or Viſibles in general; and in this Senſe it includes *Catoptricks*, *Dioptricks*, and even *Perſpective*.

Opticks is a mathematical Science that treats of the *Sight* in general, and of every thing which is ſeen with direct Rays; and explains the ſeveral Properties and Effects of Viſion in general, and properly of that which is direct and ordinary; for when the Rays of Light are conſidered as *reflected*, the Science which teaches their Laws and Properties is call'd *Catoptricks*; and when the *Refraction* of Rays is conſider'd, and the Laws and Nature of it explain'd and demonſtrated, the Science is call'd *Dioptricks*; or

Opticks in its extenſive Signification may be conſider'd as a mixt mathematical Science, explaining the Manner wherein Viſion is perform'd in the Eye; treats of the Sight in the general; gives the Reaſon of the ſeveral Modifications or Alterations which the Rays of Light undergo in the Eye, and why Objects appear ſometimes bigger and ſometimes ſmaller, ſometimes more diſtinct, ſometimes more confus'd, ſometimes nearer

nearer and ſometimes farther off.

In this extenſive Signification it is conſider'd by Sir *Iſaac Newton* in his admirable Work call'd *Opticks*; from *Opticks* likewiſe ariſes *Perſpective*; all the Rules of which have their Reaſon or Foundation in *Opticks*; and though *Tacquet* makes *Perſpective* a Part of *Opticks*, yet *John* Archbiſhop of *Canterbury*, calls *Opticks*, *Catoptricks* and *Dioptricks*, by the Name of *Perſpective*.

OPTICK *Pencil* or Pencil of Rays, is that Aſſemblage of Rays, by Means whereof any Point or Part of an Object is ſeen.

OPTICK *Pyramid* [in *Perſpective*] is a Pyramid, whoſe Baſe is the viſible Object, and its Vertex in the Eye; form'd by Rays drawn from the ſeveral Points of the Perimeter.

OPTICK *Rays* are particularly us'd for thoſe wherewith an *Optick Pyramid* or *Optick Triangle* is terminated, as

OPTICK *Axis*, is a Ray paſſing through the Centre or the middle of the *Optick Pyramid*.

OPTICK *Chamber*; or call'd CAMERA OBSCURA, is the Name of an Optick Machine; wherein (the Light only coming through a double Convex Glaſs) Objects expoſed to broad Day-Light, and oppoſite to the Glaſs, are repreſented inverted upon any white Matter placed within the Machine in the Focus of the Glaſs.

The Repreſentations of Objects in this Machine are wonderfully pleaſant, not only becauſe they appear in their juſt Proportions, and are endued with all the natural Colour of their Objects; but likewiſe ſhew their various Motions which no Art can imitate; and a ſkilful Painter by the Aſſiſtance of one of theſe Machines, may obſerve many Things from the Contemplation of the Appearance of Objects therein, which will be an Help to the Perfection of the Art of *Painting*, and even a Bungler may accurately enough delineate Objects by Means of it.

Mr. *Graveſend* at the End of his Perſpective has given the Deſcription and Uſe of two Machines of this Kind, which are the beſt that have yet been made, eſpecially the former.

OPTICK *Glaſſes*, are Glaſſes that are ground either Concave or Convex, ſo as either to collect or diſperſe the Rays of Light; by Means of which, Viſion is improv'd, and the Eye ſtrengthened, preſerv'd, &c.

ORATORY [in *Architecture*] is a Cloſet or little Apartment in a large Houſe near a Bed Chamber, furniſh'd with a little Altar, or an Image for private Devotion (among the *Romaniſts*).

The ancient Oratories were little Chappels adjoining to Monaſteries, where the Monks ſaid their Prayers before they had Churches.

ORDER [in *Architecture*] is a Syſtem of the ſeveral

Members

mbers, Ornaments and Proportions of Columns and Pilars; or it is a regular Argement of the projecting ts of a Building, especially fe of a Column; so as to n one beautiful whole: Or *der* is a certain Rule for the portions of Columns, and the Figures which some of Parts ought to have, on Account of the Proportions t are given them.

M. *Le Clerc* defines an *Or-* to be a Column charg'd h an *Entablature*, and supted on a Pedestal.

The Origin of Orders may said to be almost as ancient human Society; the Rigour the Seasons first put Men on making little Cabins to re into; at the first they e made half under Ground, half above, and were coed with Stubble. But in ne growing more expert, y laid Trunks of Trees an d, and laid others a-cross to r up the Covering.

rom hence they took the Hint more regular Architecture; Trunks of Trees upright, resenting Columns; and the ds or Bands which serv'd to p the Trunks from burst- express'd Bases and Capi-; and the Summers which a-cross, gave the Hint of ablatures; and likewise did Coverings ending in Points, a Notion of Pediments. s Hypothesis we have from *ruvius*, and it has been well strated by M. *Blondel*.

Others are of the Opinion Columns took their Rise from the Pyramids which were erected by the Ancients over Tombs; and that the Urns wherein their Ashes were inclos'd, represented the Capitals, the *Abacus* of which was a Brick laid over to cover the Urn: But *Vitruvius*'s Account seems the most natural.

In time, the Height of Columns were regulated by the *Greeks* on the Foot of the Proportion of a human Body. The *Doric* represented a Man of a strong, robust make; the *Ionic* that of a Woman, and the *Corinthian* that of a Girl; Their Bases and Capitals were their Shoes, Head Dress, &c.

The three *Greek* Orders represent three different Manners of Building, *viz.* the *solid*, *mean*, and *delicate*; the two *Italian* ones, are imperfect Productions of these.

The little Regard the *Romans* had for these last, appears from this, that we meet not with one Instance in the *Antique* where they are intermixt.

Daviler observes, that the Abuse the Moderns have introduc'd by the Mixture of the *Greek* and *Latin* Orders, arises from their Want of Reflection on the Use which the Ancients made thereof.

The Definitions *Vitruvius*, *Barbaro*, and *Scamozzi*, have given of Orders, are so obscure, that it is not worth while to spend Time in repeating them; it is sufficient to observe, that there are five *Orders* of Columns; three of which are *Greek*; *viz.* the *Doric*, *Ionic*, and

and *Corinthian*; and two *Italian*, *viz.* the *Tuscan* and *Composite*.

To give a general Idea of the *Orders*, it will be necessary to observe, that the whole is compos'd of two Parts at least, *viz.* the Column and the Entablature, and of four Parts; at the most; where there is a *Pedestal* under the Columns; and one *Acroter* or little Pedestal on the Top of the Entablature.

That the *Column* has three Parts, *viz.* the *Base*, the *Shaft* and the *Capital*; the *Entablature* has three likewise, *viz.* the *Architrave*, the *Frize* and the *Cornice*; which Parts are all different in the several Orders, having each their particular Characters and Members, call'd by the general Names of *Mouldings or Ornaments.*

These Orders took their Names from the People among whom they were invented. *Scammozzi* calls the *Tuscan* the *Gigantick*; the *Doric*, the *Herculean*; the *Ionic*, the *Matronal*; the *Composite*, the *Heroick*, and the *Corinthian* the *Virginal*.

I shall here present you with what M. *Le Clerc* gives us, relating to the Orders.

An Order of Columns is usually understood of a Column bearing its Entablature; but the Order is scarcely compleat except the Column be rais'd on a Pedestal.

The Pedestal, Column and Entablement, are three Compound Parts, each consisting of three Others, as has been said before.

The Ancients have given five several Orders of Colu[mns] the *Tuscan*, *Doric*, *Io[nic]* *Roman* and *Corinthian*.

The *Tuscan* ORDER is [the] first, most simple and solid, [its] Column is seven Diame[ters] high, and its Capital, [Base] and Entablature, have but [few] Mouldings for Ornaments.

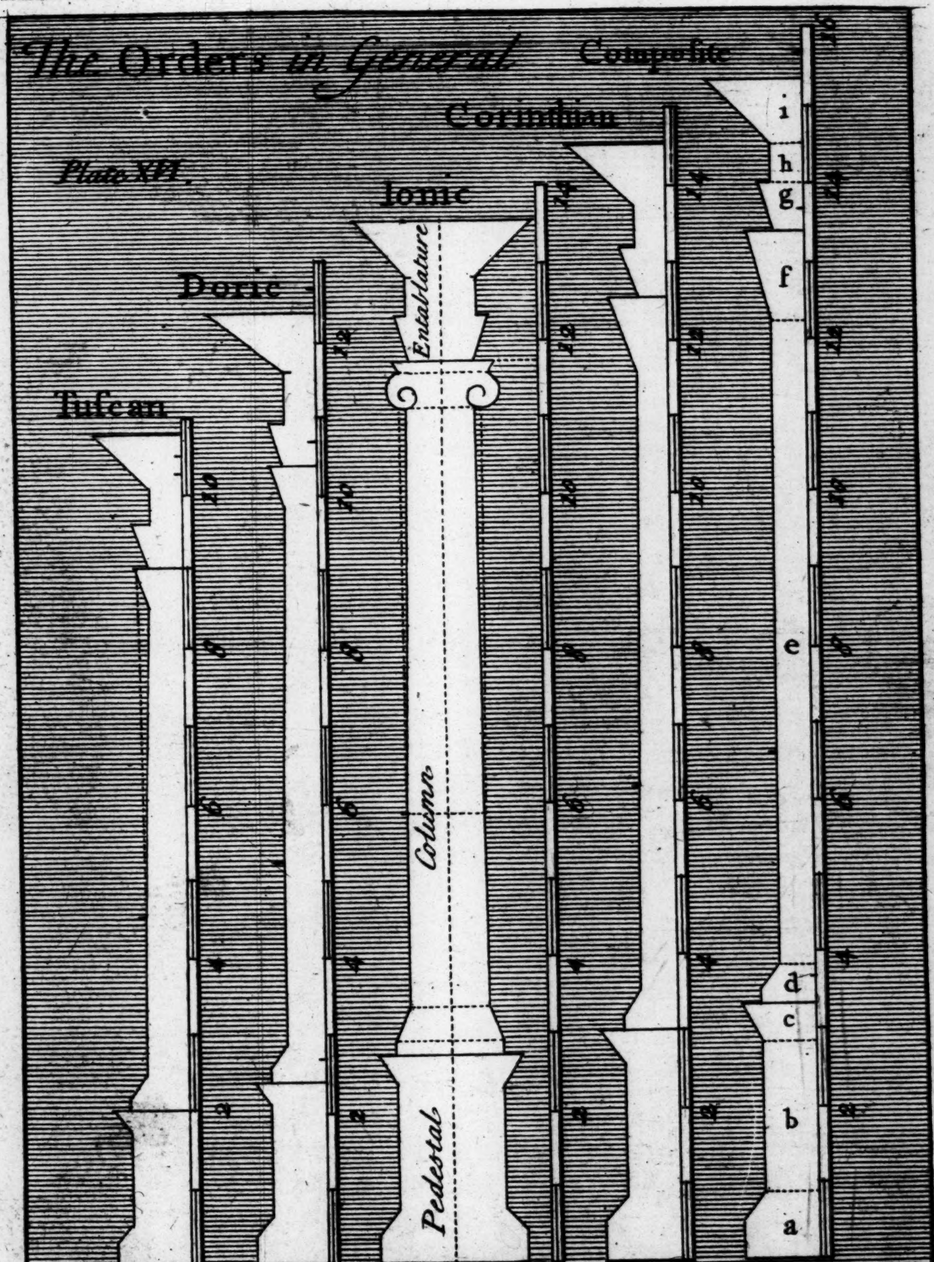
If we give Credit to M[.] *Cambray* in his Parallel, [this] Order ought never to be [us'd] any where but in Rusticks, Country Houses and Places.

And indeed, in the Ma[nner] that *Vitruvius*, *Palladio*, [and] some others describe it, it sc[arce] deserves to be us'd at all.

Methinks however in *Vig[no]la*'s Manner of Composition [it] has certain Beauties in its S[im]plicity, which add a Valu[e to] it, and render it worthy [to] be us'd, not only in pri[vate] Houses, but also in pub[lick] Buildings; as in Portico[s of] Markets; of publick Halls, Magazines or Granaries of [Ci]ties; and even in Palaces [and] Seats of Princes and Noble[men,] particularly in the lower Ap[art]ments, Offices, Stables, [or] Equerries as is translated th[e] &c.

And in general, in all [Pla]ces, where Strength and S[im]plicity are required, and w[here] any of the richer and more [de]licate Orders would be un[suit]able.

The *Doric* ORDER is [the] Second, and most agreeab[le to] *Nature*. It is the most anc[ient,] and given us by the *Gr[eeks.]* It has no Ornament on its [Base] or on its Capital. Its H[eight]


The Orders in General
Plate XVI.
Tuscan
Doric
Ionic
Corinthian
Composite
Entablature
Column
Pedestal
a
b
c
d
e
f
g
h
i
2
4
6
8
10
12
14
16

16

eight Diameters. Its Frieze distinguish'd by Triglyphs d Metopes.

Its Composition is grand and ble, and the Triglyphs which ake the Ornaments of its ieze, bearing some Resemance to a Lyre, seems to inmate it to have been originally intended for some Temconsecrated to *Apollo*.

As we are now furnish'd h richer and more delicate naments, the *Doric* is most perly us'd in the Gates of ies, in Arsenals and Places Arms; in Halls of Guards, l other Buildings, which have lation to War; where Strength a rough, but noble Simity, are particularly rer'd.

n the most ancient Monunts of this *Order*, the Cons are without Bases, the son of which is not easy to gn.

M. *de Cambray* in his *Paral*is of the same Opinion with *ruvius*, that the *Doric* Con, not the *Ionic*, (as the nslator of *Le Clerc* has it) ng been compos'd in Imion of a naked Man, nervous robust, as an Hercules, it ht to have no Base; imagina Base to be that to a Con, which a Shoe is to a . But for my own Part, I t confess, I can't consider a mn without a Base, but mparing it to a Man; I ra form the Idea of a Man out Feet, than without s.

r this Reason, I am rather pinion, either that the ancient Architects had not yet thought of adding Bases to their Columns, or that they declin'd, on Purpose, to give them any, with design to keep the Pavement clear, and unembarrass'd with the Angles and Projectures of Bases, which are apt to occasion People passing by to stumble.

This also appears the more probable, in Regard that the Architects of those Times us'd to range their Columns exceedingly near one another; so that if they had been furnish'd with Bases, the Passages between, would have been extremely narrow and incommodious.

And this appears to be the Reason, why *Vitruvius* orders the Plinth of the *Tuscan* Column to be rounded off; that Order in the Manner he describes it, being particularly adapted to the servile Offices of Business, and Commerce, where Conveniency is always to be consulted before Beauty.

Be this as it will, every Man of a good Taste will allow, that a Base adds a Grace to a Column, and that it is a very necessary Appendage, in Regard it makes it stand the more firmly on its Plan: so that if no Columns are made now without Bases, this ought not to be imputed to the Prejudices of our Architects, as some Admirers of Antiquity will have it; but to their Prudence.

The *Ionic* Order is the third, and a kind of mean Proportional between the solid and delicate Manner. Its Capital is

 OR

its adorn'd with Volutes, and its Cornice with Denticles.

Michael Angelo, contrary to all other Authors, gives the *Ionic* a single Row of Leaves, at the Bottom of the Capital.

The first Idea of this Order was given by the *Ionians*, who according to *Vitruvius*, compos'd this Column on the Model of a young Lady, dressing in her Hair, of an easy and delicate Shape; as the *Doric* had been form'd on the Model of a strong robust Man.

It is said, the Temple of *Diana* at *Ephesus*, the most celebrated Edifice of all Antiquity, was of this Order.

It may now be us'd in Buildings of Piety, as in Churches, Courts of Justice, in Apartments of Ladies, and in other Places of Quietude and Peace.

The *Corinthian* Order invented by *Calimachus*, is the fourth, the richest and the most delicate. Its Capital is adorn'd with two Rows of Leaves, and eight Volutes, which sustain the *Abacus*. Its Column is ten Diameters high, and its Cornice has Modillions.

This is indeed a Master Piece of Art, for which we are indebted to the City of *Corinth*. It ought always to be us'd in most stately and most magnificent Buildings.

The *Composite* or *Roman* Order, is the fifth and last (tho' *Scammozzi* makes it the fourth). It is call'd the *Composite*, because its Capital is compos'd out of those of the other Orders; having two Rows of Leaves of the *Corinthian*, and the Volutes of the *Ionic*. It also call'd the *Roman*, becau invented among that Peop Its Column is ten Diame high; and its Corniche h Denticles or simple Modillio

This Column has also Quarter Round as the *Tusc* and *Doric*. Most of our A chitects in Compliance w Usage and Custom, place t after the *Corinthian*; doubtl because it was the last t was invented. *Scammozzi* the only Author who var from the Rule, but he doe with so much Judgment, t we scruple not to imitate hi

This Order may be us'd every Place, and on every O casion, where 'tis requir'd t Strength, Richness and Bea should be found together.

Rustick Order is that dorn'd with Rustick Quo Boscages, &c.

Attick Order is a little *der* of low Pilasters, with architrav'd Corniche for Entablature, as that of the stle of *Versailles*, over the *nic*, on the Side of the Gar

M. *Blondel* calls the l Pilasters of *Atticks* and *M* *zanines*, false *Orders*.

Persian Order is that wh has Figures of *Persian* Sla instead of Columns to sup the Entablature.

Caryatick Order, is whose Entablature is supp with Figures of Women ins of Columns.

Gothic Order, is an der which deviates from Ornaments and Proportio the Antique; and whose

lu

mns are either too massive, in anner of Pillars; or too nder, like Poles; its Capi-s out off all Measure; and v'd with Leaves of wild *canthus*, Thistles, Cabbage, the like.

French ORDER, is a new ntriv'd *Order*, wherein the pitals consist of Attributes reeing to that People, as ck's Heads, Flower de Lys, *c.*

The Proportions of this Or-r are *Corinthian*. Such is at of M. *Le Brun*, in the and Gallery of *Versailles*, d that of M. *Le Clerc*.

M. *Le Clerc* gives a second *scan* Order, and a *Spanish* der, besides his *French* Or-r. The *Tuscan* he ranks be-een the first *Tuscan* and *Do-c*. He makes the Height of 23 Semi-Diameters, 22 Mi-tes; the Columns to have 15, Pedestal 5, and the Enta-ature 3 and 22 Minutes, and proposes its Frieze to be orn'd with Turtles; which the Arms of *Tuscany*.

He places the *Spanish* Order tween the *Corinthian* and *mposite*. He makes the whole der 30 Semi-Diameters, 28 nutes; the Column of which s 19 and 25 Minutes, the destal 16, and 18 Minutes, d the Entablature, 4 and 15 nutes.

The Horns of the *Abacus* he tains with little Volutes; middle, in Lieu of a Rose, s a Lion's Snout; that Ani-l being the Symbol of *Spain*, d expressing the Strength, avity, and Prudence of that tion.

These several Orders, says M. *Le Clerc*, speaking of the five first, have been very judi-ciously compos'd at various Times, in order to suit the va-rious kinds of Buildings, which either Necessity or Magnificence should occasion Men to erect, and these are ever made more or less simple, each in its Kind; and more or less slender, ac-cording to the Buildings they are us'd in, and the Riches of the Princes, People, or private Persons who build them.

M. *Le Clerc* treats of the different Manners wherein the five Orders or Columns have been treated, with some use-ful Remarks on those of *Pal-ladio* and *Vignola*.

He says, if these Orders of Columns had any positive Beauties, easy and obvious to the Eye, Architects would have been oblig'd to agree among themselves, as to their Rules and Properties; but as their Beauties are in Effect merely arbitrary, and not founded on any certain Demonstrations, it happens, that those who have treated of them, have all pre-scrib'd different Rules, accord-ing as their Taste and Genius were different.

It must be own'd however, that tho' the same Order may have different Beauties, and different Proportions; yet a-mong those Beauties and Pro-portions, 'tis certain there are some that please more, and are more universally approv'd than others.

Among the several Authors who have written on Architec-

ture, *Palladio* and *Vignola* ſeem to be the moſt generally follow'd; but it is a Doubt, even among Perſons of Skill and Judgment, which of the two ought to be preferr'd to the other.

The Orders of *Palladio* have Beauties different from the Orders of *Vignola* I mean their ſeveral Orders have each of them their different Beauties; and yet the great Difference between their Compoſitions, does hardly allow us to view them without making a Choice from ſome Circumſtances.

For Inſtance, *Vignola*'s Rule of making the Entablement in all the Orders juſt a fourth Part of the Height of the Column, pleaſes me leſs than that of *Palladio*, who diminiſhes this Height in the three laſt Orders. I mean that *Vignola*'s Entablements appear heavy and lumpiſh. and eſpecially in the *Ionic*, *Corinthian* and *Compoſite* Orders; and above all, when the Columns are without Pedeſtals,

On the other Hand, *Vignola*'s Pedeſtals, whoſe Height in all the Orders is one third of that of the Columns, are in my Opinion preferable to the Pedeſtals of *Palladio*, which having leſs Height, appear flat and low.

Again, the *Zocco* of *Vignola*'s Pedeſtal ſeems too little, and that of *Palladio*, too big and ſtrong for the Pedeſtal.

Further, I cannot commend *Vignola* for giving *Vitruvius*'s Baſe to the *Ionic* Column, and for excluding the *Attic* Baſe out of all his Orders, whic[h] without Diſpute, is the mo[st] beautiful of all the Baſes [of] Columns.

Palladio too, in my Opinio[n] had done better, if in Imit[a]tion of the Ancients he h[ad] given the *Attic* Baſe to the [Io]*nic* Column, inſtead of th[e] *Doric*; in which laſt ſome mo[re] ſimple Baſe, as that for Inſtan[ce] of *Vignola*, would have be[en] more ſuitable and conſiſte[nt] with the Solidity of the Orde[r].

Add to theſe that a Man ca[n]not view *Vignola*'s *Tuſcan* O[r]der, without obſerving that *Palladio* ill conducted almo[st] in every Part; but eſpecial[ly] in the Shaft of the Colum[n] which indeed appears mo[n]ſtrous, on Account of its e[x]ceſſive Diminution towards t[he] Top; even the ſmalleſt Sha[re] of Diſcernment is ſufficient [to] diſcover this.

Methinks too, it had be[en] more juſt in *Palladio*, if [in]ſtead of Modillions in the [Io]*nic* Entablement, he had ma[de] Dentils, which, as *Vignola* h[as] very well obſerv'd, are an [eſ]ſential Ornament of this Odre[r] Modillions appearing too ſtro[ng] and maſſive for a Column t[hat] profeſſes to imitate the Deli[ca]cy of a young Woman.

Nor does it appear over ju[di]cious in *Vignola*, to uſe Den[tils] in four of the Orders; it be[ing] a Point of Prudence in an [Ar]chitect, to introduce a Dive[rsi]ty in the Ornaments, as wel[l as] the principal Members of [the] Orders.

And again, I can't but th[ink] it an overſight in *Vignola*, m[...]

ıake his Dentils leſs in the *Doric* Order, than in the *Io-ic*, *Corinthian* and *Roman*; hen 'tis own'd, that the *Doric* s conſiderably leſs delicate than ny of thoſe other Orders.

Who can approve of *Palla-io*'s making the *Corinthian* Column leſs delicate than the *Roman*, and the *Roman* Capi-l at the ſame Time leſs de-icate than the *Corinthian*? Or as it juſt in *Vignola* to make he 2 Columns, *Corinthian* and *Compoſite*, in the ſame Propor-ion?

Ought not ſome Regard to e had to the Difference of heir Capitals, and on that Ac-ount, ſhould not ſome more Delicacy be ſhewn in the *Co-inthian* Column, than the *Ro-man*?

Further it may be juſtly ſaid, hat if *Vignola* has made his Entablements too heavy in the hree laſt Orders, *Palladio* has ade his too light.

I obſerve alſo, that *Vignola* as made his Modillions in the *Corinthian* Order, too large, nſomuch that they encroach pon each other in the inner ngles of the Entablement; n which Account, the Roſes nclos'd between them, appear o ſmall, with Regard to thoſe; hich muſt be own'd to be a onſiderable Fault, that *Pal-ladio* had the good Fortune to oid, by making the Spaces etween the Modillions perfect quares.

Nor can it be deny'd that in *Vignola* the Die of the *Corin-thian* Pedeſtal is too high, and *Palladio*, too low for the ſe.

Laſtly, a Man cannot view *Vignola*'s Portico's, without ob-ſerving them to be better pro-portioned than thoſe of *Palla-dio*, which are too wide in the two firſt Orders, and too nar-row in the two laſt.

Were I to examine the Pro-files of theſe two Authors, ma-ny of them would be found in-tolerable; being compos'd of Mouldings that are ill match'd to each other, and in no wiſe ſuitable to the Places where they are found.

Of the five Orders of Ar-chitecture, *by equal Parts.*

Every *Order* is comprehend-ed under three principal Parts, *viz.* the *Pedeſtal*, the *Column* and the *Entablature*; and each Part conſiſts of three Denomi-nations; the *Pedeſtal* having its *Baſe*, *Die*, and *Cornice*; the *Column*, its *Baſe*, *Shaft*, and *Capital*; and the *Entablature*, its *Architrave*, *Frieze* and *Cor-nice*.

I. *Of the* Tuſcan *Order*.

Any Height being given, di-vide it into ten Parts and three Quarters, call'd Diameters (by Diameters is meant the Thick-neſs of the Shaft at the bottom) the Pedeſtal having two; the Column with Baſe and Capital, ſeven; and the Entablature, one and three Quarters.

II. *Of the* Doric *Order*.

The whole Height being given, is divided into twelve

Diameters or Parts, and one third; the Pedestal having two and one third, the Column eight, and the Entablature two.

III. *Of the* Ionic *Order.*

The whole Height is divided into thirteen Diameters and a half; the Pedestal having two and two thirds, the Column nine, and the Entablature one, and four fifths.

IV. *Of the* Corinthian *Order.*

The whole Height is divided into fourteen Diameters and a half; the Pedestal having three, the Column nine and a half, and the Entablature two.

V. *Of the* Composite *Order.*

The whole Height is divided into fifteen Diameters, and one third; the Pedestal having three and one third, the Column ten, and the Entablature two.

In a *Colonade* or range of Pillars, the *Intercolumniation* or Space between two Columns in the *Tuscan* Order, is four Diameters. In the *Doric* Order, two and three Quarters. In the *Ionic* Order, two and a Quarter. In the *Corinthian* Order, two: And in the *Composite* Order, one and a half. See the Plate.

ORGANICAL *Description of Curves* is the Method of describing them on a Plane, by the Regular Motion of a Point.

ORLE, ORLET, ORLO [in *Architecture*] a Fillet under the Ovolo or Quarter Round of a Capital. When it is at the Top or Bottom of the Shaft, it is call'd *Cincture*. *Palladio* uses the Word for the Plinth of the Bases of Columns.

ORNAMENTS [in *Architecture*] are us'd to signify all the Sculpture or carv'd Work wherewith a Piece of Architecture is enrich'd.

Vitruvius and *Vignola* also use the Word to signify the *Entablature*.

Ornaments in Relievo are those cut into the Contours of Mouldings, as Leaves, Shells, Scrolls, Flowers, &c.

Ornaments in Creux, are such as are cut within the Mouldings, as *Eggs*, *Flutes*, &c.

ORPIMENT is the same that some call *Yellow Arsenick*. It is a good Colour for some Uses, but is very troublesome to grind, being a mineral, stony Substance of a poisonous Quality; therefore Care ought to be taken, that the Fumes of it don't offend the Brain, in the time of grinding it.

ORTHOGRAPHY [in *Geometry*] is the Art of drawing or delineating the fore right Plan of any Object, and of expressing the Heights or Elevations of each Part.

It is call'd *Orthography* from its determining Things by perpendicular Lines, falling on the Geometrical Plane.

ORTHOGRAPHY [in *Architecture*] is the Elevation of a Building.

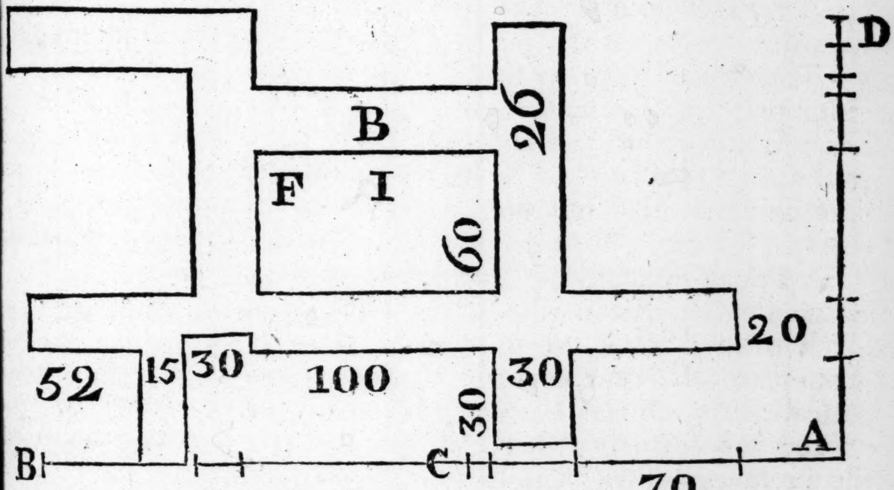
Th

The *Orthography* is either *external* or *internal*.

The *external Orthography* is taken for the Delineation of an external Face or Front of a Building; or as it is by others defin'd, is the Model, Platform, and Delineation of the Front of a House, that is contriv'd, and to be built according to the Rules of *Geometry*, according to which Pattern the whole Fabrick is erected and finish'd. This Delineation or Plat-form, exhibits the principal Wall, with its Apertures, Roof, Ornaments, and every Thing visible to an Eye, plac'd before the Building.

Internal Orthography, which is also call'd a *Section*, is a Delineation, or Draught of a Building, such as it would appear, were the external Wall removed.

To lay down the Orthography of a Building.



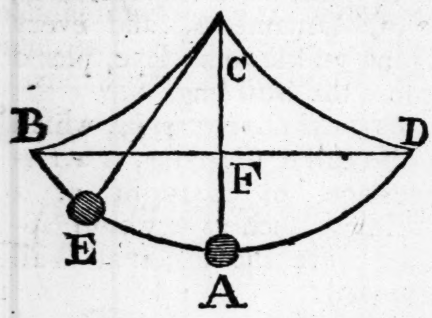
Draw a Right Line for a Base or Ground Line A B, and at one End erect a perpendicular A D upon A B, set off the Width and Distances of the Gates or Doors, Windows, &c. On the Right Line A D, set off the Heights of the several Parts visible in the Face of the Building, *v. g.* of the Doors, Windows, the Roof, Chimneys, *&c.* and apply a Ruler to each Point of Division.

The common Intersections of the Right Lines, drawn from three Points, parallel to the Lines A B and A D determine the external *Orthography* of the Building; and after the same Manner, is the internal Orthography to be laid down.

ORTHOGRAPHY [in *Perspective*] is the fore right Side of any Plane, *i. e.* the Side or Plane that lies parallel to a strait Line, that may be imagin'd to pass through the outward Convex Points of the Eyes, continued to a convenient Length. *Lamy*, and others, use the Word *Scenography* in the same Sense.

OSCILLATION [in *Mechanicks*] is the Swing or reciprocal

procal Afcent or Defcent of a Pendulum.



1. If a fingle Pendulum be fufpended between two Semi-Cycloids B C, C D, which have the Diameter C E of the generating Circle equal to half the Length of the String, fo that the String, as it ofcillates, folds about them; all the Ofcillations, however unequal, will be Ifochronal in a non refifting Medium.

2. The Time of the intire or whole Ofcillation thro' any Arch of a Cycloid, is to the Time of the Perpendicular Defcent through the Diameter of the generating Circle, as the Periphery of the Circle to the Diameter.

3. If two Pendulums defcribe Similar Arches of Circles, the times of the Ofcillations are in the Subduplicate of their Lengths.

4. The Number of Ifochronal Ofcillations made in the fame time by two Pendulums, are reciprocally as the times wherein each of the Ofcillations are made.

The Times of the Ofcillations in different Cycloids, are in the fub-duplicate Ratio of the Length of the Pendulums.

5. The Length of a Pendulum that will perform its Ofcillations in a Second, is 3 Foot, 8 Inches and a half of *Paris* Meafure.

6. The fhorter the Ofcillations in the Arch of a Circle are, the truer will the Pendulum meafure Time, or the more Ifochronal will the Ofcillations be.

Centre of OSCILLATION in a fufpended Body, is a certain Point therein, each Vibration of which is perform'd in the fame Manner, as if that Point alone were fufpended at that Diftance from the Point of Sufpenfion. Or,

It is a Point wherein, if the whole Length of a compound Pendulum be collected, the feveral Ofcillations will be perform'd in the fame Time as before.

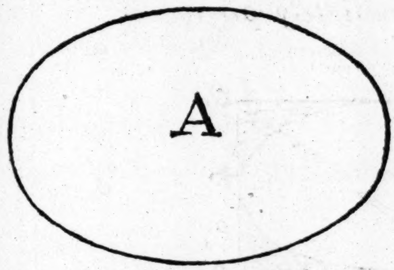
Therefore its Diftance from the Point of Sufpenfion is equal to the Length of a fingle Pendulum, whofe *Ofcillations* are Ifochronal with thofe of the Compound one.

OVA [in *Architecture*] are Ornaments in Form of Eggs, carv'd on the Contour of the Ovolo or Quarter Round; and feparated from each other by Anchors, or Arrow Heads, thefe Ornaments are ordinarily call'd *Eggs* and *Anchors*, by the *Englifh*.

The Ancients fometimes us'd Hearts inftead of Eggs, upon which Foundation it was, that they us'd Arrows to fymbolize with Love.

OVAL or *Ellipfis* [in *Geometry*] is a Figure as A bounded by a regular curve Line, return-

returning into it ſelf; but of its two Diameters cutting each other at Right Angles in the

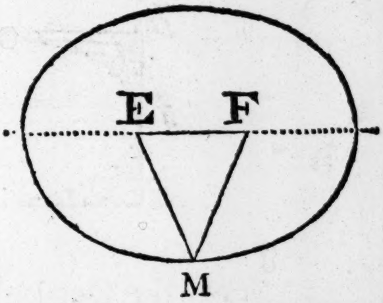


Centre, one is longer than the other, in which it differs from the Circle. Every *Ellipſis* is an *oval* Figure, but every *oval* Figure, is not an *Ellipſis*. Or,

An Oval may be defin'd a Figure incloſ'd with a ſingle curv'd Line, imperfectly round, its Length being greater than its Breadth; like an Egg, whence it takes its Name.

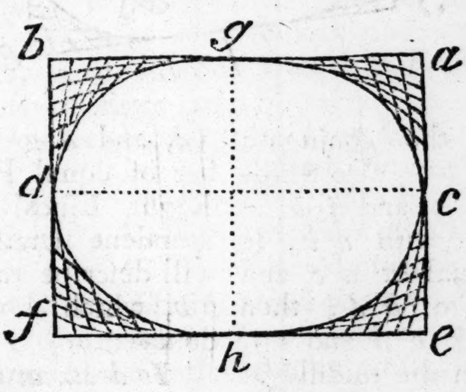
The proper Oval or Egg Shape, is an irregular Figure, being narrower at one End than the other; in which it differs from the Ellipſis, which is the mathematical Oval, and equal in Breadth at each End.

Theſe two are confounded together by the common People, and even Geometricians call the Oval a falſe Ellipſis.



The Method commonly us'd by Workmen in deſcribing an Oval, is by a Cord or String, as F M E, whoſe Length is equal to the greater Diameter of the Oval, and which is faſtened by its Extremes to two Points or Nails, E, F, planted in its longeſt Diameter, by which Means the Oval is made as much longer, as the two Points or Nails are farther apart.

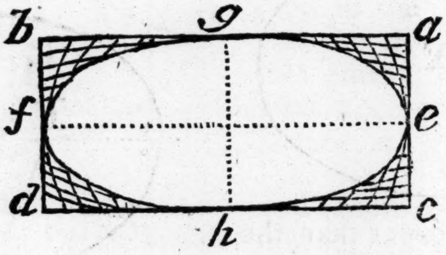
To draw an Oval by Interſection of Right Lines.



Firſt, Deſcribe the out Lines *a b*, *b e*, *f e*, and *e a*, at Right Angles to each other; afterwards draw the Conjugate Diameter *c d*, alſo the tranſverſe Diameter *h g*, and divide *a g*, and *a c* into any Number of equal Parts; alſo *c b* and *b d*, *d e*, and *f h*; and *h e* and *e c*, and draw Right

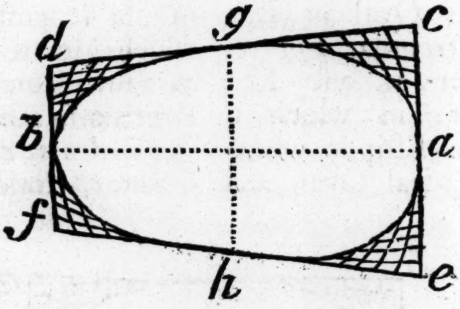
Right Lines from Division to Division, as before, which will describe the Oval *c, g, d, h*, which was to be done.

To describe an Oval, whose Transverse Diameter is less than in the preceeding next immediately preceeding.



First, Draw the Out-Lines *a b, b d, d c*, and *c a*, at Right Angles to each other; and afterwards draw the conjugate Diameter *e f*, also the transverse Diameter *g h*; then divide *a g* and *a e* into any Number of equal Parts; also *g b* and *b f*; *f d*, and *d h*, *h c* and *c e*, from which, draw Right Lines as before, which will describe the Oval *e g f h*.

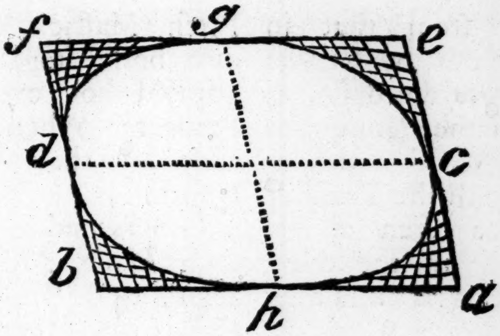
To draw an Egg or Oval, one End larger than the other.



First, Draw the conjugate Diameter *a b*, afterwards draw Lines *e c* and *f d* at Right Angles with *a b*, so that *a c* is equal at *a e* and *b f* is equal to *b d*; then draw the Lines *c d* and *e f*, which divide in the middle at *g* and *h*, and draw the Line *g h* for the transverse Diameter; then divide *e h*, and *e a*, and also *a c*, and *c g* into any Number of equal Parts; and divide *b f*, *f b*, *b d*, and *d g* into any Number of equal Parts, and draw Right Lines to each Correspondent Division, and they will describe the Figure *a g*, *b h*, which is what was to be done.

To draw an oblique Oval.

First, Describe the Out-Lines *a b*, *a e*, *e f* and *f b*, and draw the conjugate Diameter *c d*; also the transverse Diameter *h g*; and observe that *e f* is equal to *a b*, and *b f* is



is equal to *a e*: then divide each Line, that is, between Letter and Letter, into one equal Number of Parts, and draw Right Lines as before, which will deſcribe the Oval *c g d h*, which was requir'd.

OVOLO [in *Architecture*] is a round Moulding, whoſe Profile or Sweep in the *Ionic* and *Compoſite* Capitals, is uſually a Quadrant of a Circle; whence it is alſo popularly call'd the *Quarter Round*.

It was uſually enrich'd with Sculpture by the Ancients, in the Form of Cheſnut-Shells, whence *Vitruvius* and others call'd it *Echinus*, *i. e. Cheſnut-Shells*.

Among us, it is uſually cut in the Likeneſs of Eggs and Anchors, or Arrow-heads, plac'd alternately.

OVICULUM [in the ancient *Architecture*] a little Ovum or Egg.

OVER-SPAN. See *Clamp*.

OXYGONE, [in *Geometry*] is the ſame as an acute angled Triangle.

OXYGONAL } [in *Geometry*]
OXYGONOUS }
ſignifies acute angled; ſomething with an Angle leſs than 90 Degrees.

P.

PADDUCK, or *Paddock Courſe*, a Piece of Ground conveniently taken out of a Park, uſually a Mile in Length and a Quarter of a Mile in Breadth, encompaſs'd with Pales or a Wall, for exhibiting Races with Grey-Hounds, for Wagers, *&c.*

PAINTING [*in Oil*] the Art of Painting in Oil, was unknown to the Ancients, and was firſt diſcovered and put in practiſe in the Beginning of the XIV Century, by a *Flemiſh* Painter, nam'd *John van Eyck*, or *John de Bruges*. Painting before his Time, was all perform'd in *Freſco* or Water Colours.

This Invention was of very great Uſe to the Art of Painting, ſince by Means hereof, the Colours of a Painting, are preſerv'd much longer and better, and receive a Luſtre and Sweetneſs, which the Ancients could never attain to, what Varniſh ſoever they made Uſe of, to cover their Pieces.

The whole Secret conſiſts only in grinding the Colours with Nut-Oil or Linſeed Oil: but the Manner of working is very

very different from that in *Fresco*, or in Water, by Reason that the Oil does not dry near so fast; so that the Painter has an Opportunity of touching and retouching all the Parts of his Figures, as often as he pleases; which in the other kinds of Painting is a Thing impracticable.

And besides, the Figures in this Way of Painting, have more Force and Boldness, in as much, as the Black becomes blacker when ground with Oil, than with Water. Besides, that all the Colours mixing better together, render the Colouring sweeter, softer, more delicate, and give an Union and Softness to the whole Work, which is inimitable in any of the other Manners.

Painting in Oil, is perform'd on Walls, Wood, Stone, &c. To paint on a Wall, when it is well dry, they give it two or three Washes of boiling Oil, till the Plaister remain quite greasy, and will imbibe no more. Upon this they lay drying Colours, *viz.* white Chalk, red Oker, or other Chalks, beaten pretty stiff. When this Couch or Lay is well dry, they sketch out and design the Subject to be painted, and at last paint it over, mixing a little Varnish with their Colour, to save the varnishing afterwards.

Others to fortify the Wall better against Moisture, cover it with a Plaister of Lime, Marble Dust, or a Cement made of beaten Tiles soak'd in Linseed Oil; and at last they prepare a Composition of *Greek* Pitch, Mastick, and thick Varnish boil'd together, which is apply'd hot over the former Plaister: When this is dry, they lay their Colours on as before.

Others make their Plaister with Lime, Mortar, Tile Cement, and Sand; and when this is dry, they lay on another of Lime, Cement or Machefer, or Iron Scum; which being well beaten and incorporated with Whites of Eggs and Linseed Oil, makes an excellent Couch or Plaister, on which when it is dry, the Colours are laid as before.

In painting on Wood, they usually give their Ground a Couch or Lay of White, tempered with Size; or they apply the Oil above-mention'd: the Rest is after the same Manner as in painting on Walls.

To paint on Linnen or Canvas. The Canvas being stretch'd on a Frame, they give it a Couch or Lay of Size: When it is dry they go over it with a Pumice-Stone, to smooth off the Roughness. The Size lays all the little Threads and Hairs close on the Cloth, and the little Holes are stopp'd up, that no Colour can come through.

When the Cloth is dry, they lay on Oker, which is a natural Earth, and bears a Body, sometimes mixing with it a little white Lead to make it dry the sooner, and when it is dry, they rub it with a Pumice Stone to make it smooth.

After this, sometimes is added a second Lay, compos'd of White Lead and a little Char-

coal

coal black, to render the Ground of an Ash Colour; taking Care in each Manner to lay on as little Colour as possible, that the Cloth may not break, and that the Colours when they come to be painted over, may preserve the better.

Therefore as little Oil as possible is to be us'd, if you would have the Colours keep fresh; and therefore some mix them up with Oil of Aspic, which evaporates immediately, and serves to make them manageable with the Pencil.

To paint on Stones, it is necessary to apply Size, as on Cloth; it will be sufficient to add a slight Couch of Colours, before the Design is drawn.

PAINTING of *Timber Work*. The Manner of colouring all Manner of Timber-Work, as Wainscot, Doors, Windows, Posts, Rails, Pales, Gates, Border Boards for Gardens, *&c.* which require either Beauty or Preservation from the Violence of Rain, or Injury of Weather, is as follows.

Suppose there be a Set of Pallisades, or a Pair of Gates, or some Posts and Rails to be painted in a Stone Colour.

First, Look over the Work, and take Notice whether the Joints be open in the Gates, or whether there be any large Clefts in the Posts; for if these are not secur'd, the Wet will insinuate it self into those Defects, and make the quicker Dispatch in rotting the whole Work.

Therefore the first Thing to be done, is to stop up those Clefts, *&c.* smooth and even, with a Substace which Painters call *Putty*, which is made of Whiting and Linseed Oil, well beaten together on a grinding Stone, or with a wooden Mallet, to the Consistence of a very thick Dough, and with this, let all the Crannies, Clefts and other Defects be well fill'd up, so that it may be equal to the Surface or out Side of the Things to be painted.

Then Prime the Work with *Spanish* Brown, well ground, and mixt very thin with Linseed Oil; with this do over the Work, giving it as much Oil as it will drink up; this in about two Days will be indifferent dry; then if you would do the Work substantially, do it again with the same Priming Colour; when it is thorough dry, take White Lead, well ground and tempered with Linseed Oil, but not too thin; for the stiffer you work it, if it be not too stiff, the better Body will be laid on, and the longer it will last; rub this Colour on well with a large Bristle Brush; that the whole Surface of the Work be so intirely covered, that no crack nor corner may remain bare; which may be easily done by jobbing in the Point of a Bristle Brush.

Let this first Colouring dry, and then go over it a second time, and if you please, a third also; the Charge will be but little more, but the Advantage will be great in the Duration.

This Course is sufficient for every

every Kind of Timber Work, which requires only a plain Colour; whether you cover the Work with a Stone Colour, or else with a Timber Colour with Umber and White, or a Lead Colour with Indigo and White.

Some lay over their Work only a Coat of *Spanish* Brown, by tempering it up more stiff than was done for the two first Primings, which, in some Respects, is the cheapest Way of all, and preserves the Timber perhaps as well as Any.

Note, If when you have made Use of your Colours, there be Occasion for a small Cessation, till the Work be finish'd; in this Case, you must cover the Colour that remains in the Pot with Water, which will prevent its drying and skinning over.

And the Pencils also or Brushes should be wash'd out in clear Linseed Oil; and then in warm Soap Suds; for if either Oil or Colours be once dry'd in the Brush, or Pencil, they are spoil'd for ever.

It has been observ'd, that Timber laid over with White when it has stood some time in the Weather, the Colour will crack and shrink up together, just as Pitch does, if laid on any Thing that stands in the Sun; the Cause of this is that the Colour was laid on with too stiff a Body; for being wrought too thick once, it will dry with a Skin on the Outside, which will keep the Inside moist, and prevent its binding firm, from whence those Cracks proceed.

Of Out-Door painting in General.] Doors, Shop-Windows, Window-Frames, Pediments, Architraves, Friezes and Corniches, and all other Timber Works that are expos'd to the Weather, ought at first setting up, to be prim'd with *Spanish Brown*, *Spanish White*, and *Red Lead* (about a fifth) to cause the other two Colours to dry.

These being well ground with Linseed Oil, will make a very good Primer: Then afterwards with the same Colour, (but whiter) for a second Primer, and lastly with a fair White, made of White Lead and about a fifth Part in Quantity, (not in Weight) of *Spanish White*.

Now he that is able to bring the Work thus far on, has proceeded to the highest Pitch of that vulgar Painting, that aims at Preservation beyond Beauty; tho' something of Beauty is necessarily included in this also; but this is not all, for he that is arriv'd thus far, is in a fair Way to other Perfections in the Art of Painting; but for the Panelling of Wainscot with its proper Shadows, and for imitating Olive and Walnut Wood, Marbles, and such like, they must be attain'd to by ocular Inspection, it being impossible to deliver the Manner of the Operation by Precept, without Example; and I am bold to affirm, that a Man shall gain more Knowledge by one Day's Experience, than by an Hundred spent to acquire it some other Way.

I adviſe therefore all thoſe at deſire an Inſight into the ſineſs, to be a little curious, Opportunity offers, in obſerv- g the Manner of a Painter's orking, not only in grinding Colours, but alſo in laying em on, and working in them; all theſe obſerving the Mo- n of his Hand, in the ma- ge of any Kind of Tool; d by this Means, with a little itation, join'd to the Direc- ns here given; I doubt not t in a ſhort time, you may rive to great Proficiency in Buſineſs of vulgar Painting.

Take Notice, that if you all at any Time have Occaſion uſe either Bruſhes that are ry ſmall, or Pencils, as in any Caſes there will be Oc- ſion, you ought then to diſ- ſe of the Colours you uſe on a Pallet (*which is a woo- n Inſtrument, eaſy to be had any Colour-Shop*) and there rk and temper them about th your Pencil, that the ncil may carry away the ore Colour; for you are to *te*, that if a Pencil be only t in a Pot of Colour, it brings no more with it than what ngs on the Outſide, and that ll work but a little way, ereas if you rub the Pencil out in the Colour, on the llet, a good Quantity of Co- r will be taken up in the dy of the Pencil; and be- es all this, you may work r Pencils better to a Point a Pallet, than you can do in Pot; the Point of a Pencil ng of greateſt Uſe in divers ſes, eſpecially in drawing of Lines, and all kind of Flou- riſhing.

How to ſcour, refreſh and preſerve all Manner of Oil Paintings.

The Oil Paintings that I here intend, are only ſuch as are kept from the Injuries of Wea- ther; for ſuch Paintings as en- dure the Fury of Rain and Storms (ſuch as Sun-Dials, Poſts, Pales, *&c.*) are not any ways to be renewed or refreſh- ed, but by being new coloured with the ſame Colour, in which it was at firſt wrought, becauſe that the Body and Strength of the Colour, is worn out by con- tinual Aſſaults of waſting Time, and cannot be made freſh, un- leſs new done over once in four or five Years, or more accord- ing as the Weather is found to wear it off, and make it look dull.

But as for ſuch Painting that is ſhelter'd from Weather, as all In-Door Paintings are, they ſtill keep their Body and Colour, although their Beauty may be much impaired by Duſt, Smoak, Fly-ſhits, and the like, which will in time ſoil and tar- niſh them; to remedy which, take theſe few Rules:

If your Painting be Wain- ſcotting, or any other Joinery or Carpentry Work that is painted in Oil, take Wood- Aſhes well ſifted, which mix with Water ſomewhat thick, then take a large ſtrong Briſtle Bruſh, and dip it in the moi- ſtened Aſhes, and therewith rub and ſcour your Painting all

over very gently in all Places alike, and you will find that all the Soil is taken off, then wash it clean with fair Water, and let it dry; and you will find your Painting to be near as fresh as when laid on.

But if your Painting be more curious, whether Figures of Men, Beasts, Landskip, Frutage, Florage, or the like, then let your Picture be gently scoured, and then cleanly washed off with fair Water; after it is well dry, let it be run over with Varnish, made with White of Eggs, and you will find the Beauty and Lustre of your Picture much recovered.

The Whites of Eggs beforementioned, are only to be beaten to an Oil, and then curiously rubbed on either with a clean Linnen-Cloth, or a Pencil.

But *Note*, That this scouring of Pictures ought not to be practised but very seldom (*as when your Picture is very much soiled*) because often and too frequent doing this, must needs wear off a little of the Colours; therefore strive what you can to preserve their first Beauty, by keeping them free from Smoak, and by often striking off the Dust with a Fox-Tail; as likewise preserving them from Flies, by burning Brimstone sometimes to kill them, or by dressing up your Rooms with green Boughs, to which the Flies will gather themselves, and so not hurt your Pictures.

Sir *Hugh Platt* in the first Part of his *Garden of Eden*, and 17 *Page*, tells us of *Italian* Fancy for that Purp[ose] by hanging in the Roof a[nd] Sides of the Room small Po[m]pions or Cucumbers stuck f[ull] of Barley, which will spro[ut] into green Spiers, on which [the] Flies will lodge. *Query*, Whether a Vessel of Tin made rou[nd] about full of Holes filled wi[th] Earth, and every Hole plant[ed] with a Corn of Barley, and w[a]tered as Need requires, wou[ld] not be more beautiful and u[se]ful to this Purpose?

Another Note worth Obse[r]vation is, that all Pictures (*espe*[-]*cially those that are wrought with Mixtures of White Lea*[d]) are apt to tarnish and gro[w] rusty, as is seen in all ancie[nt] Pieces; to prevent which, i[n] the Months of *May* and *Ju*[ne] let your Pictures be expose[d] sometimes to the hot Sun, fo[r] this will draw off much of th[e] tarnish, and make the Colou[rs] more fresh and beautiful: an[d] thus doing from Year to Yea[r] will preserve them wonde[r]fully.

Out Door Work thus colour[]ed, may be afforded to be don[e] for 3*d.* 3½*d.* or 4*d.* the Yar[d] Square, for each time lai[d] over.

Of Measuring.] Painters mea[]sure their Work by the Yar[d] superficial, and in taking th[e] Dimensions of their Work, the[y] run a String all over wher[e] the Brush has been, for the[y] say (and it is but Reason) th[at] they ought to be paid for a[ll] where the Brush goes.

But sometimes in Rails o[r] Bannisters, they will measur[e] i[t]

as if it were flat Measure ; indeed upon trying the Ex- iment, there has been so lit- Difference found, that it ld not countervail the Trou- of girting and casting up.

o that Painters Work is asured the same as Joiners, y Painters never reckon rk and Half; but work e, twice, three times, &c. e over; or at so much *per* d, according to the Work.

hey always reckon double k for painting Window tters, if both Sides are ted alike, otherwise ac- ing to the Value of the ting.

hey reckon Sash-Frames hemselves (at so much *per* e, and likewise Mantle- es) when there is no Paint- about them; but if they in the Wainscot, they ure them as plain Work, educting any Thing for acancy.

ainscot Colour] If on new , is worth about 8 *d. per* , on old Colour, about 7 *d.*

alnut-Tree Colour.] Some is worth 10 *d.* but others, 18 *d. per* Yard.

dinary branch'd Painting] aid to be worth 12 *d.* 14 *d.* *d. per* Yard.

inary Marble Colour.] If w Stuff, is worth 1 *s. per* on old Stuff, 9 *d.*

ite Colour] is worth 10 *d.* *per* Yard.

in Japan, either black ite] is worth 3 *s.* 6 *d.* or r Yard.

es and outward Doors] rth 3 *d.* 3½ *d.* or 4 *d. per*

Shop-Windows] are of the same Price as Gates and outward Doors.

Window Frames] are worth from 3 *d.* to 8 *d.* each Light, according to their Size.

Sash-Lights] are worth about 1 *s. per* Light.

Sash-Frames] are worth about 1 *s. per* Frame.

Iron Casements] are worth Three Half pence, 2 *d.* or 3 *d.* *per* Casement, according as they are in Bigness.

Iron Bars of Windows] are worth 1 *d. per* Bar, or more, if very large.

Chimney-Pieces] are worth about 2 *s. per* Chimney-Piece.

Pales are worth about 10 *d.* or 1 *s. per* Yard.

Colours.] The Colours us'd in Painting are, *White* and *Red Lead*, *Spanish*, *White Brown*, *Verdigrease*, *Smalt*, &c.

Painters Work.

The taking of the Dimensions, is the same with that of Joiners, by girting over the Mouldings &c. in taking the Height, and it is but reasonable that they should be paid for what both their Time and Colour are expended in. The casting up after the Dimensions have been taken and reduc'd into Yards, is altogether the same with that of Joiners Work; but the Painter never reckons Work and Half; but reckons his Work once, twice or thrice colour'd over.

But this is to be remembred, that Window-Lights, Window-Bars, Casements, and such like

Things, are done at ſo much *per* Piece.

Example. If a Room be painted, whoſe Height (being girt over the Mouldings) is 16 Feet 6 Inches, and the Compaſs of the Room be 97 Feet 9 Inches, how many Yards are in that Room?

Multiply 97 Feet 9 Inches by 16 Feet 6 Inches, and the Product will be 1612 Feet, 10 Inches, 6 Parts; which being divided by 9, the Quotient will be 179 Yards and 1 Foot.

F.	I.	
97	9	
16	6	
584		
98		
48	10	6
9)1612	10	6

97 . 75
16 . 5
48875
58650
9775
1612.875

Facit 179 Yards, 1 Foot.

By Scale and Compaſſes.

Extend the Compaſſes from 9 to 16.5, and that Extent will reach from 97.75 to 179.2 Yards.

PALE [in *Carpentry*] a little pointed Stake of Wood, us'd in making Incloſures, Separations, &c.

PALES } PILES } are Rows or Files of Stakes driven into the Ground, to make wooden Bridges over Rivers, they ſerve to ſupport the Beams which are laid acroſs them from one Row to another; and are ſtrongly bound together with croſs Pieces.

PALEING with cleft Pales, Rails and Poſts. For paleing with 3 Rails, Cleft Pales, Rails and Poſts, cleaving, making, and ſetting up, the uſual Price is ſaid to be 3 *s.* 6 *d.* or 4 *s.* *per* Rod, felling the Timber and all; but then they muſt have their Materials all laid down at their Hand, ſo that they have no carrying.

Some ſay they have 2 *s.* 6 *d.* *per* Rod for only making and ſetting up of Clefts Poſts, Rails, and Pales.

Sawn Pales, Rails and Poſts ſome ſay are ſet up at 1 *s.* 6 *d.* *per* Rod.

The Price of Cleaving Pales is about 20 *d.* or 2 *s.* *per* Hundred.

A hundred of Pales vary according to their Length; of five Foot Pales, five Score makes a hundred; of four Foot Pales, ſix Score, and of three Foot, ſeven Score go to the Hundred.

It is very uncertain what Number a Tun of Timber will make, by Reaſon of the Difference of the Timbers cleaving, ſome cleaving much better (and with leſs waſte) than other.

But a Tun of good cleaving imber, may make about 300 4 Foot Pales, or 400 of 3 oot Pales; becauſe the Timr generally cleaves better and ſs to waſte in ſhort Lengths, an in longer.

But the Number of *ſawn* *Pales* that may be made out of a Tun of Timber is more certain than that of *Cleft-Pales*, for it has been found, that a Tun of Timber will make about 400 Foot of Inch Boards, (the Timber being of fit Length) being cut out

into	5 4 Foot 3	Pales, will make	80 100 130	Pales each a Foot broad;

hich in Paleing will reach out three times as far as the e Number of Cleft Pales ill do.

PALLISADE } is a Sort of PALLISADO } ſlight open le or Fence, ſet to beautify e Place, Walk, *&c.*

There is ſuch Variety in the orkmanſhip of Palliſado les, that there can be no cern Price by the Rod.

Palliſado Gates are as varis in their Forms and Faſhions Palliſado Pales, and conſeently their Prices are alſo various, *viz.* from 6 or 7 to or 12 *s. per* Yard, running eaſure at about 7 Foot high.

Iron Palliſado Work in Gates otherways, is from 4 *d. per* und, to 8 *d.* according to the ork.

PALLIFICATION [in *Arcitecture*] is the pileing of the round Work; or ſtrengthen- it with Piles or Timber iven into the Ground; which practis'd when they build on a moiſt or marſhy Soil.

PALLIER } [in *Building*] PAILLIER } is ſometimes d for a Landing Place in a air Caſe; or a Step, which being broader than the Reſt, ſerves to reſt upon.

PANNEL [in *Joinery*, &c.] is a Tympanum or ſquare Piece of thin Wood, ſometimes carv'd, fram'd or grov'd in a larger Piece between two Montants or upright Pieces, and two Traverſes or croſs Pieces.

PANNELS or Panes of Glaſs are Compartiments or Pieces of Glaſs.

PANNEL [in *Maſonry*] is one of the Faces of a hewn Stone.

PANNIER [in *Architecture*] See *Corbel*.

PANTHEON [in *Architecture*] is a Temple or Church of a Circular Form; dedicated to all the Gods, or all the Saints.

PANTRY, a Room to ſet Victuals in; a Store Room.

PAN-Tiles, See *Tiles*.

PARABOLA is a Curve, as E D F made by cutting a Cone by a Plane D G parallel to one of its Sides; as in the Figure; See *Plate*, Fig. 1,

PARABOLICK *Pyramidoid*, is a ſolid Figure, generated by ſuppoſing all the Squares of the Ordinates Applicates in the

the Parabola, so plac'd as that the *Axis* shall pass through all their Centres at Right Angles; in which Case, the Aggregate of the Planes, will be arithmetically proportional; whose Solidity is gain'd by multiplying the Base by half the Altitude.

PARABOLICK *Space*, is the Area contain'd between the Curve of the Parabola, and a whole Ordinate A B.

This is $\frac{2}{3}$ of the circumscribing Parallelogram A C D B in the common Parabola; See the *Plate*, Figure 2.

PARABOLICK CUNEUS, is a Solid mention'd by Dr. *Wallis*, and is form'd thus; multiply all the D B s into the D S s, or which is all one upon the Base A F B erect a Prism, whose Altitude shall be A S, and this shall be the Parabolick Cuneus, which is equal in Solidity to the *Parobolical Pyramidoid*; See the *Plate*, Figure 3.

PARABOLICK SPINDLE is a Solid made by the Relation of a Semi-Parabola about one of its Ordinates, and is equal to $\frac{8}{1}$, of its circumscribing Cylinder.

PARABOLOIDES }
PARABOLIFORM *Curves* } are Parabolas of the higher Kind.

PARALLEL [in *Geometry*] is a Term apply'd to Lines, Figures and Bodies, which being prolonged, are still at equal Distance from one another.

PARALLEL *Planes* are those Planes which have all the Perpendiculars drawn betwixt them, equal to e[ach] other; that is, when they [are] equally every where distant.

PARALLEL RULER [is] an Instrument of Wood, Br[ass] &c. consisting of two Paral[lel] Rules, which open and sh[ut] parallel to one another, and [is] of great Use in all Parts [of] Mathematicks, where ma[ny] parallel Lines are to be dra[wn.]

PARALLEL *Rays* [in *O[p]ticks*] are those that keep [an] equal Distance from the vi[si]ble Object to the Eye, wh[ich] is suppos'd to be infinitely [re]mote from the Object.

PARALLELISM is t[he] Quality of a *Parallel*, or th[at] which denominates it such, [or] it is that whereby two Thi[ngs] *v. gr.* Lines or Rays, bec[ome] equi-distant from one anoth[er.]

PARALLELOGRAM [in] *Geometry*] is a Right L[ined] quadrilateral Figure, wh[ose] opposite Sides are parallel [and] equal.

1. The opposite Angles [of] all Parallelograms are equal [to] one another.

2. All Parallelograms t[hat] are between the same Para[llel] Lines, and on one and the sa[me] Base, are equal.

3. All Similar Parallelogr[ams] are to one another in the [du]plicate Ratio of their homo[lo]gous Sides.

4. The Area of any Par[al]lelogram is had by multiply[ing] one of its Sides by a Perpen[di]cular let fall from one of [the] opposite Angles.

PARALLELOGRAM, [is] also an Instrument made of [] Rulers of Brass or Wood, w[]

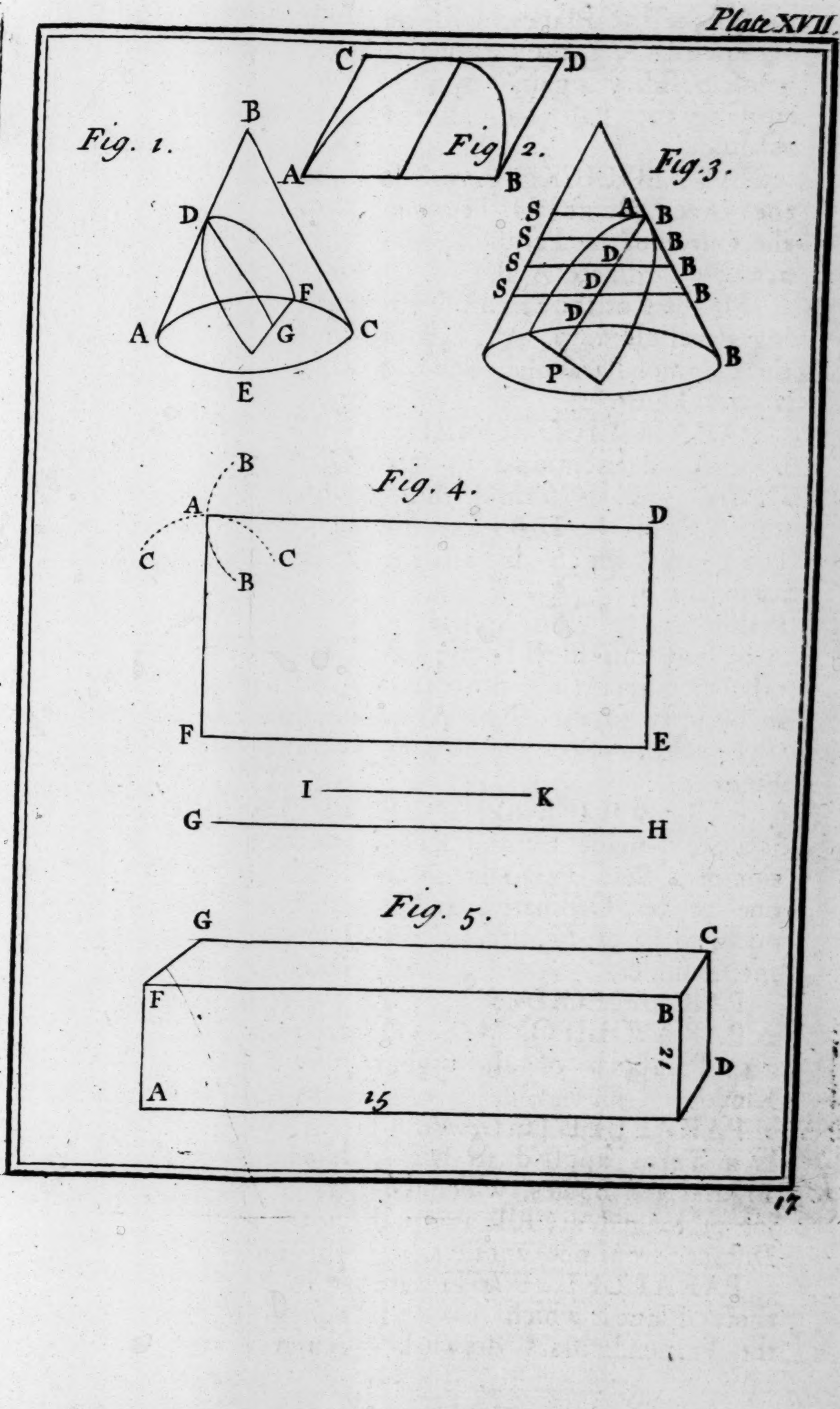


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
15
21

ckets to slide or set to any oportion, us'd to enlarge or minish any Map or Draught, ther in Building, Surveying, c.

To describe the oblong PA-ALLELOGRAM ADFE, hose Length shall be equal to e given Line G H.

First, make F C = to G H, d on E erect the Perpendi-lar E D = I K; then on D ith the Radius G H, describe e Arch B E; and on the Point with the Radius I K, de-ribe the Arch C C.

Secondly. Join A F and A D d they will compleat the blong. See the *Plate*, Fi-re 4.

PARALLELOGRAM-ICK PROTRACTOR, is Semi-Circle of Brass, with ur Rulers, in Form of a Pa-llelogram made to move to y Angle; one of which Ru-rs is an Index, which shews the Semi-Circle, the Quan-y of any inward or outward ngle.

PARALLELOPIPED [in *eometry*] is a solid Figure ntain'd under six Parallelo-ams, the opposite Sides of hich are equal and parallel; or 'tis a Prism, whose Base is a Parallelogram, this is always triple to a Pyramid of the same Base and Height.

Let A B C D E F G be a Parallelopipedon or a square Prism, representing a square Piece of Timber or Stone, each Side of its Square Base A B C D, being 21 Inches, and its Length A E, 15 Foot.

First, then multiply 21 by 21, the Product is 441, the Area of the Base in Inches; which multiply'd by 180, the Length in Inches, and the Product is 79380, the Solid Content in Inches.

Divide the last Product by 1728, and the Quotient is 45.9, that is 45 Solid Feet and 9 Tenths of a Foot: Or thus, multiply 441 by 15 Feet, and the Product is 6615; divide this by 1444, and the Quotient is 45 . 9, the same as before.

Or thus, by multiplying Feet and Inches.

Multiply 1 Foot 9 Inches, by 1 Foot 9 Inches, and the Product is 3 Feet 0 Inches, 9 Parts; this multiply'd again by 15 Feet, gives 45 Feet, 11 Inches, 3 Parts; that is 45 Feet, and $\frac{11}{12}$ of a Foot, and $\frac{1}{4}$ of $\frac{1}{12}$.

See the Work of all these.

```
   21            441                F.    I.
   21             15                1     9
  ----          -----               1     9
   21           2205               ----------
  42            441                 1     9
  ----          -----               1     3     9
  441      144) 6615 (45 : 9       ----------------
   180          -----               3     0     9
  ----           855               15
 35280          1350               ----------------
  441           -----              45     3     9
  ----            54
                 1 4                         1728)
```

1728) 79380 (45 : 9
6912

10260
8640

16200
15552

648

7 6
3 9

45 11 3

By Scale and Compasses.

Extend the Compasses from 13 to 21, and that Extent wi reach to near 46 Foot, bein twice turn'd over from 1 Foot; so the Solid Content i almost 46 Feet.

If the Base of the Squar solid, be not an exact Square but in the Form of a Rectan gled Parallelogram, the Wa of measuring it is much th same; for first you must fin the Area of the Base by mu tiplying the Breadth by th Depth, and then multiply th Area by the Length of th Piece, as before: thus,

If a Piece of Timber be 2 Inches broad, 9 Inches deep an 25 Feet long, how many soli Feet are contain'd therein?

25
9

225
25

1125
450

5625

144) 5625 (39
432

1305
1296

09

Answer 39 Feet.

F.		I.	
2		1	
0		9	
1		6	9
25			
25	:	0	0
12	:	6	0
1	:	0	6
0	:	6	3
39	:	0	9

By Scale and Compasses

First, Find a mean Geometrical Proportional between the Breadth and the Depth; which to do upon the Line of Numbers, you must divide the Space upon the Line between the Breadth and the Depth into two equal Parts; that middle Point will be the mean Proportional sought: Thus the midd Point between 25 and 9 is at : So is 15 a mean Proportion between 9 and 25: for 9 : : : 15 : 25; so a Piece of Tin ber 15 Inches square is equ to a Piece 25 Inches broa and 9 Inches deep.

So then if you extend t

Compass

Compasses from 12 to 15, that Extent turn'd twice over from 25 Feet; the Length will reach to 39 Feet, the Content. See *Plate*, Figure 5.

PARALLELOPLEURON [with some *Geometricians*] is a Word us'd to signify an imperfect Parallelogram, or a kind of *Trapezium*, having unequal Angles and Sides, yet not also in regard that at least some of them answer to one another, observing a certain Regularity and Proportion of Parallels; so that they do not extend so largely as *Trapeziums*, which are any irregular four sided Figures; nevertheless like them they are capable of being variously diversified.

PARAMETER [in *Geometry*] a constant Right Line in several of the Conic Sections, call'd also *Latus Rectum*.

PARASTATA [in the ancient *Architecture*] an Impost or kind of *Anta* or *Pilaster*, built for the Support of an Arch, or as some will have it, Pilasters which stand alone, not adjoining to the Wall. *Daviler* makes Parastata the same as *Impost*; but *Evelyn*, the same as *Pilaster*.

PARAPET [of the *Italian* *Parapetto*, a save-Breast] is a little Wall, or sometimes a Rail, serving either as a *Rest* for the Arm, or as an Inclosure about a Key, Bridge, Terras, &c.

PARGETING [in *Building*] is us'd for the plaistering of Walls; sometimes it is us'd to signify the Plaister it self.

As to the various Kinds, &c.

1. With Lime, Hair and Mortar laid upon bare Walls, at 3 *d.* or 4 *d.* the Yard.

2. Upon bare Laths, as in Partitioning and plain Ceilings from 8 *d.* to 14 *d.* *per* Yard.

3. Rendring the Insides of Walls, or doubling Partition Walls, at 2 *d.* or 3 *d.* *per* Yard.

Rough casting upon Heart-Laths, from 1 *s.* to 3 *s.* *per* Yard, Workmanship, and all Materials.

5. Plaistering upon Brick-Work, with finishing Mortar in Imitation of Stone Work, from 1 to 2 *s.* *per* Yard Square.

6. The like upon Heart-Laths, from 18 *d.* to 2 or 3 *s.*

PARLOUR, a fair lower Room design'd principally for the Entertainment of Company.

Aliquant PART, is a Quantity, which being repeated any Number of Times, becomes always either greater or less than the whole; thus 5 is an Aliquant Part of 17, and 9 an Aliquant Part to 10.

Aliquot PART, is a Quantity which being repeated any Number of Times, becomes equal to the whole.

PASS-PAR-TOUT; a master Key or Key that opens indifferently several Locks, belonging to the same Lodge or Apartment.

PASSAGE, an Entry or narrow Room, serving only for a thoroughfare or Entrance into other Rooms.

PATER-NOSTERS [in *Architecture*] are certain Ornaments plac'd underneath the

Ovolo's

Ovolo's, cut in the Form of Beads, round or Oval.

PAVEMENT a Lay of Stone or other Matter, ſerving to cover and ſtrengthen the Ground of divers Places for the more commodious walking on.

In ſome Places, as in *France*, the publick Roads, Streets, Courts, &c. are pav'd with *Gres*, a kind of Free Stone.

In *Venice*, the Streets, &c. are pav'd with Brick; Churches ſometimes with Marble, and ſometimes with Moſaic Work, as the Church of St. *Mark*, at *Venice*.

In *Amſterdam* and the chief Cities of *Holland*, they call their Brick Pavement, the *Bourgher Maſters Pavement*, to diſtinguiſh it from the Stone or Flint Pavement, which is uſually in the middle of the Street, ſerving for the Paſſages of their Horſes, Carts, Coaches and other Carriages; the Brick Borders being deſign'd for the Paſſage of People on Foot.

In *England* the Pavement of the Grand Streets, &c. are uſually Flint or Pebbles, Courts, Equerries, Kitchins, Halls, Churches, &c. are uſually Tiles, Bricks, Flags or Fire-Stone; ſometimes a kind of Free-Stone and Rag-Stone.

Pavements of Free-Stone, Flint and Flags in Streets &c. are laid dry, *i. e.* are retained in a Bed of Sand, thoſe of Courts, Equerries, Ground Rooms, &c. are laid in a Mortar of Lime and Sand, or in Lime and Cement, eſpecially if there be Vaults or Cellars underneath.

Some Maſons after laying a Floor dry, eſpecially of Brick, ſpread a thin Mortar over it, ſweeping it backward or forwards, to fill up the Joints.

PAVEMENT *of a Terras*, is that which ſerves for the Covering of a Platform, whether it be over a Vault, or on a wooden Floor.

Thoſe over Vaults, are uſually Stones ſquared and bedded in Lead.

Thoſe on Wood are either Stones with Beds for Bridges; Tiles for Ceilings in Rooms, or Lays of Mortar made of Cement and Lime with Flints or Bricks, laid flat, as is ſtill practis'd by the Eaſtern and Southern People, a Top of their Houſes.

PAVING is the Laying a Floor with Stones, Bricks or Tiles.

Paving or laying with *Free-Stones*, *i, e.* with broad Stones, taken out of the Quarrys, and cut into Lengths and Breadths promiſcuouſly (as they will hold, and in Thickneſs about two or three Inches, is uſually reckon'd at 6 *d.* 7 *d*, or 8 *d.* the Foot ſquare, or 4 *s.* 6 *d.* 5 *s.* 3 *d.* and 6 *s.* the Yard Square, for Stone and Workmanſhip.

This kind of Paveing is laid in common Yards and Paſſages, before Shop Doors, Stalls, &c.

But if the Stones be ſquared all to a Size (as ſometimes theſe Stones are cut perfectly ſquare, as paving Tiles are; but much larger, as 18, 20 and 24 Inches Square and upwards) then as they are neater, ſo

they are dearer, as 12 *d.* or 14 *d.* *per* Foot, or 9 *s.* or 10 *s.* 6 *d.* *per* Yard.

But if the Stones thus ſquar'd and ſiz'd be good and well poliſh'd (as they ought to be for Kitchins, Dairies and neat Places) then they may be worth 15 or 16 *d. per* Foot, or 11 *s.* 3 *d.* or 12 *s.* *per* Yard ſquare.

Paving with Rigate Stones]. This kind of Pavement is good for Chimney Fire Hearths, Ovens, Stoves, *&c.* and it is ſometimes dearer than common *Purbeck* Pavement. See *Fire Stone.*

Paving with Marble is of all other the moſt beautiful, of which there are ſeveral Sorts, as white, black and grey: Some Pavements (as of Foot Paces before Chimneys) are laid all of one Sort or Colour, and in one intire Stone; others of two Colours, laid ſquare or checquer Ways; the Side of the one, by the Side of the other; others are laid Arracewiſe of two Colours, laid Angle to Angle, and this laſt is the neateſt Way.

But there may be divers Forms contriv'd to lay them in, as may be ſeen in ſeveral Chancels, in the Choir of St. *Pauls*, and the *Royal Exchange* in *London*, and divers other Places.

This Sort of Pavement is valued from 2 to 3 *s.* *per* Foot ſquare and upwards according as 'tis well laid and poliſh'd. See *Marble.*

Paving with Rough or Rag Stone, is the cheapeſt of all Pavements, and is valued from 15 to 18 *d.* *per* Yard.

Paving with Statute Bricks. This is done at *London* for about 4 *d. per* Yard.

But it is ſaid, that a Workman has in *Suſſex* 5 or 6 *d. per* Yard; but then into this Price they make ready the Floor for the Work; by clearing out the Earth, and levelling the Floor with a convenient Quantity of Sand (if they lay the Bricks dry, as ſometimes they do) which they ſpread evenly with a Rake) then laying the Bricks level by a Line, they with a Trowel put a ſufficient Quantity of Sand under each Brick, to raiſe it full as high as (or a little higher than) the Line, and ſo knock it down level with the Line, with the Handle of their Hammer, which when they have done, they ram in the Sand (on the Side of, and) againſt the Bottom of the Brick, with the Handle of their Hammer, to make it lie faſt.

The whole Floor being laid after this Manner, they ſtrew Sand all over the Bricks, to the Thickneſs of an Inch, and order the People of the Family to let it lie ſo for five or ſix Weeks, only ſweeping it to and fro' now and then; that thereby, and by Means of their treading on it, it may fill up all the Joints between the Bricks.

If the Bricks are laid in Mortar, the Price is much the ſame as if they were laid dry.

There are ſome Maſons who when they have laid the Floor dry,

dry, will ſpread the Floor all over with very thin Mortar, and ſweep it to and fro' with a Broom, to fill up the Joints of the Bricks.

This Sort of Paving (with common Statute Bricks) is uſual for Cellars, Waſh-Houſes, Sinks, Fire-Hearths, and for Halls and Kitchins in common Houſes.

32 of theſe Bricks will pave a Yard ſquare, if laid flat ways; and 64, edge ways.

Paving with ſquare Tiles, or as they are call'd by ſome, Paving Bricks.

The Paving with ſquare Tiles, is commonly valued by the Square, and by how much the Tiles are the ſmaller, by ſo much the dearer.

Theſe Tiles are of ſeveral Sizes, *viz.* 6, 8, 10 and 12 Inches ſquare; their Price from 6 to 20 *s. per* Hundred.

In *Suſſex*, 9 Inch Tiles are ſold for 1 *d. per* Tile or 8 *s. per* Hundred.

If you would know how many of either of theſe Sort of Tiles will pave any Floor,

Note that	36	Tiles of	6	Inches ſquare, will pave a ſquare Yard.
	21		8	
	16		9	
	13		10	
	9		12	

Paving with Flemiſh Bricks] The Paving with theſe Bricks, is far neater and ſtronger than common Bricks. The Colour of them is a dirty yellow, and they muſt be laid in Sand. Theſe Bricks are ſix Inches and a quarter long, two Inches and a half broad, and one Inch and a quarter thick.

Now allowing a quarter of an Inch for the Joint, then 72 of them will pave a Yard ſquare; but if they be ſet edgeways, then it will require 100 Bricks to pave a Yard ſquare.

Theſe Bricks are uſually ſold at 2 *s.* the Hundred, and the Price of laying them is 4 *d.* 5 *d.* or 6 *d.* the ſquare Yard.

Diamond Pavement, Mr. *Wing* ſays is worth 3 *d.* or 4 *d. per* Foot.

Random Pavement.] This Mr. *Wing* ſays at the Quarry is worth 2½ *d.* or 3 *d per* Foot.

Of the meaſuring of a Pavement.] This is commonly meaſured by the Yard ſquare.

Therefore take the Length of any Pavement in Feet and Inches, and multiply it by the Breadth in Feet and Inches, by *Croſs Multiplication*, which ſee, and the Product will be the Content in Feet; which being divided by 9 (becauſe 9 ſquare Feet make a ſquare Yard) will give the Content in Yards required.

PEDIMENT [in *Architecture*] is a kind of low Pinnacle ſerving to crown an Ordnance or finiſh a Frontiſpiece, and plac'd as an Ornament over Gates, Doors, Windows, Niches, Altars, &c. it is ordinari-

ily of a triangular Form; but ometimes makes an Arch of a Circle.

Vitruvius obſerves that the Pinnacles of the plaineſt Houſes, gave Architects the firſt Idea of this noble Part, which ſtill retains the Appearance of its Original.

The Parts of a Pediment are the *Tympanum* and the *Corniche*.

The firſt is the Pannel, naked or Area of the Pediment, inclos'd between the Corniche which crowns it, and the Entablature which ſerves it as a Baſe or Socle.

Architects have indeed taken a great Deal of Liberty as to the Form of this Member.

The moſt beautiful according to *Daviler*, is where its Height is about $\frac{1}{5}$ of the Length of its Baſe.

Vitruvius calls the Pediment *Faſtigia*, which ſignifies a Roof rais'd or pointed in the middle, which Form among the *Romans*, was peculiar to Temples.

All their Dwelling Houſes are cover'd in the Platform Manner; and it is obſerv'd by *Salmaſius* on *Solin*, that *Cæſar* was the firſt who obtain'd Leave to Roof his Houſe with a Ridge or Deſcent, after the Manner of Temples.

The *Pediment* is uſually triangular, and ſometimes an equilateral Triangle, call'd alſo a *pointed Pediment*, it is ſometimes circular, tho' it has been obſerv'd by Mr. *Felibien*, that we have no Inſtance of round Pediments in the antique, beſides thoſe in the Chapels of the *Rotundo*.

Sometimes its upper Corniche is divided into three or four Sides or Right Lines. Sometimes the Corniche is cut or open a Top, which is an Abuſe introduc'd by the Moderns, particularly *Michael Angelo*; for the Deſign of this Part at leaſt over Doors, Windows, *&c.* being chiefly to ſhelter thoſe underneath from the Rain; to leave it open in the middle, is to fruſtrate its Ends.

Sometimes the Pediment is form'd of a couple of Rolls or Wreathes like two Conſoles join'd together.

Sometimes the Pediment has no Baſe, or its lower Corniche is cut out, all but what is beſtow'd on two Columns or Pilaſters, and on theſe is rais'd an Arch or Sweep, inſtead of an Entablature; of which *Serlio* gives an Inſtance in the Antique in a *Corinthian* Gate at *Foligni* in *Umbria*; and *Daviler*, a modern one, in the Church of St. *Peter* at *Rome*.

Under this kind of Pediments, come thoſe little arch'd Corniches, which form Pediments over Doors and Windows, ſupported by two Conſoles, inſtead either of Entablature or Columns.

Sometimes the Pediment is made double, *i. e.* a leſs Pediment is made in the Tympanum of a larger, on Account of ſome Projecture in the middle, as in the Frontiſpiece of the Church of the great *Jeſus* at *Rome*: But this Repetition

is

is accounted an Abuſe in Architecture, altho' it be authoriz'd by very good Buildings, as the large Pavilion of the *Louvre*, where the *Caryatides* ſupport three Pediments one in another.

Sometimes the Tympanum of the Pediment is cut out, or left open to let in Light, as is ſeen under the Portico of the Capitol at *Rome*.

Laſtly this open Pediment is ſometimes triangular, and enrich'd with Sculpture, as Roſes, Leaves, *&c.* as is found in moſt of the *Gothic* Churches.

M. *Le Clerc* obſerves, that the Modillions in the Corniche of the Pediment, ſhould always anſwer exactly over thoſe of the Entablature.

Indeed *Vitruvius* ſays, the Ancients did not allow any Modillions at all in Pediments.

M. *Le Clerc* alſo obſerves, that the Corniche which ſerves the Pediment as a Baſe, ſhould have no Cymatium, by Reaſon the *Cymatium* of the Reſt of the Entablature when it meets the *Pediment*, paſſes over it.

This Change of Determination occaſions a conſiderable Difficulty; the *Cymatium* in this Caſe, appearing too broad in the Turn of the Angle; to remedy which, Architects have Recourſe to ſeveral Expedients.

A *pointed Pediment* may crown three Arches; but a *circular Pediment*, can only crown agreeably.

There ſhould never be us'd more than two *Tympana* over each other in the ſame Frontiſpiece; and even where there are two, it would be proper to have the lower circular, and the upper, pointed.

PEDESTAL [in *Architecture*] is the loweſt Part of an Order of Columns; being that which ſuſtains the Column and ſerves it as a Foot or Stand.

The Pedeſtal which the *Greeks* call *Stylobates* and *Stereobates*, conſiſt of three principal Parts, *viz.* a *Square*, *Trunk*, or *Die*, which makes the Body; a *Corniche*, the Head; and a *Baſe* the Foot of the Pedeſtal.

The Pedeſtal is properly an Appendage to a Column, not an eſſential Part of it; tho M. *Le Clerc* thinks it is eſſential to a compleat Order.

There are as many kind of Pedeſtals, as there are of Orders of Columns, *viz*, 5. The *Tuſcan*, *Doric*, *Ionick*, *Corinthian* and *Compoſite*.

Some ſay the Height of the Pedeſtal in each Order, ought to be a third Part of the whole Column, comprehending the Baſe and Capital, and their upper Adjuncts. as Architrave, Frieze and Corniche, a fourth Part of the ſame Pillar.

The *famous* Engliſh Architect, Sir *Henry Wootton* ſays, he finds this Rule of ſingular Uſe and Facility, ſettled by *Jacobo Baroccio*, whom he eſteemed a more credible Author than others (as a Man that moſt intended this Piece of Architecture) than any that vary from them in theſe Dimenſions.

Indeed *Vignola* and moſt of the

he Moderns make the Pedestal and its Ornaments in all he Orders, one third of the Height of the Column, including the Base and Capital, but ome deviate from this Rule.

M. *Perrault* indeed, makes he Proportions of the three onstituent Parts of *Pedestals*, he same in all the Orders, *iz.* the Base or Socle one ourth of the *Pedestal*, the orniche an eighth Part, and he Socle or Plinth of the Base, vo thirds of the Base it self. he Height of the Die, is hat remains of the whole eight of the *Pedestal*.

Tuscan Pedestal (according *Vitruvius*) the whole Height the *Tuscan* Column comprending the Architrave Frieze d Cornice is divided into Nine rts, two of which go to the eight of the Pedestal.

This Pedestal is by him deib'd in two different *Forms*, e of which is plain, having ly a Plinth for the Base, and other for the Capital; the ight of each of those Plinths $\frac{1}{6}$ of the whole Height of Pedestal, and the Projecture these Plinths is $\frac{1}{6}$ of their ight.

n the *Pedestal* that he debes, of the other Form he divides the whole Height the Pedestal into six Parts, of which goes to the Base, one to the Capital.

nd again he divides the into two Parts, one of h goes to the Plinth below, the other to the Rest of the ; this is also subdivided inur Parts, and three of them goes to the *scima reversa*, and the List below it which is $\frac{1}{2}$ a Part, and the other to the List above it.

Palladio and *Scamozzi* make the *Tuscan Pedestal* three Modules high; *Vignola* Five.

Its Members in *Vignola* are only a *Plinth* for a Base, the *Die*, and a *Talon* crowned for a Corniche; the Tuscan Column has rarely any.

The *Dorick Pedestal*. *Vitruvius* divides the whole of this Column (comprehending the Architrave, Frieze and Corniche) into eight Parts, two of which go to the Height of the Pedestal, which agrees with *Jacobo Baroccio*'s Rule.

Vitruvius also describes this Pedestal in two different Forms; in both of which, the Base and Capital are each $\frac{1}{7}$ of the whole Height of the *Pedestal*.

He divides the Base of one of the fashioned Pedestals into two Parts, one of which goes to the Plinth below, and the other to the rest of the Base: and this Part being again sub-divided into two Parts, one of them makes the lower *Thorus*; and the other is sub-divided again into three Parts, two of which go to the upper *Thorus*, and the other to the List above it.

The *Capital* of the *Pedestal* of this Fashion is divided into 4 Parts, the lowermost of which makes the *Astragal* (whose List is $\frac{1}{3}$ of the whole Astragal, and the other three Parts go to the *Cymatium*, the List of which at the Top, is one of these Parts.

The Height of the Base of the Pedestal of the other Fashion

is

is also divided into two Parts, the lowermoſt of which goes to the Plinth, and the other Part being again ſub-divided into three Parts, two of them make the *Thorus*, and the other Part of the Liſt above it.

The whole Height of the Capital of the Pedeſtal of this Faſhion is divided into five Parts, the lowermoſt of which goes to the *Aſtragal*. (Whoſe Liſt is $\frac{1}{3}$ of the whole,) the next two Parts go to the *Ogee*, and the two Parts that remain are ſub-divided into three Parts, the lowermoſt of which go to the Square, and the other to the *Cymatium*, whoſe Liſt is $\frac{1}{3}$ of the whole.

Palladio makes the *Dorick Pedeſtal* four Modules five Minutes high, *Vignola* 5 *Modules* four Minutes.

In the Antique, we not only dont meet with any Pedeſtal; but even not with any Baſe in the *Dorick* Order.

The Members of *Vignola*'s, *Dorick Pedeſtal* are the ſame with thoſe of the *Tuſcan*, with the Addition of a Mouchette in its Corniche.

The *Ionic* Pedeſtal. The whole Height of this Column being divided into fourteen Parts, the Height of its Pedeſtal (according to *Vitruvius*) is three of theſe Parts.

He alſo deſcribes this Pedeſtal in two different Forms, the Baſe and Capital of each of which are each $\frac{1}{3}$ of the whole Height of the Pedeſtal.

He divides the Height of the Baſe of one of theſe faſhionent Pedeſtals, into three Parts, the lowermoſt of which goes to the *Plinth*, the next to the *ſcima reverſa*, with its Liſt at Top and Bottom, which are each $\frac{1}{6}$ of the whole; the uppermoſt Grand Diviſion being ſub-divided into two, the lowermoſt of them goes to the *Caſement* or *Hollow*, with its Liſt at the Top, which is $\frac{1}{5}$ of the whole: The other Part goes to the *Thorus*: And its Liſt above it, which Liſt is $\frac{1}{3}$ of the whole. The Capital of the Pedeſtal of this Faſhion is divided into two Parts, the lowermoſt of which goes to the *ſcima reverſa*, with its Liſt above and below it: The lower Liſt is $\frac{1}{4}$ of the whole, and the upper Liſt $\frac{1}{6}$ of the Remainder. The other Grand Diviſion being ſub-divided into three Parts, the two lowermoſt of them go to the Square, and the other to the *Cymatium*, the Liſt of which is $\frac{1}{3}$ Part of the whole *Cymatium*.

In the Pedeſtal of the other Faſhion, the Baſe is alſo divided into three Parts, the lowermoſt of which goes to the Plinth, the other two Grand Diviſions are again divided into Five, and the three lowermoſt of them go to the *ſcima reverſa*, and the Liſt under it, which Liſt is $\frac{1}{6}$ of the whole; the other two Diviſions are again ſub-divided into three Parts, the two Lowermoſt of which go to the *Thorus*, and the remaining Part to the Liſt above it.

The *Capital* of the Pedeſtal of this Faſhion is divided into two Parts, the lowermoſt of which being ſub-divided into four Parts, the lowermoſt of

the

hem goes to the Aſtragal (of hich its Liſt is $\frac{1}{3}$ Part) the o- her three of thoſe ſub-diviſions o to the *ſcima reverſa*, and its Liſt above it, which Liſt is $\frac{1}{6}$ f the whole; the other Grand Diviſion is alſo ſubdivided into hree Parts, the two lowermoſt f which go to the Square, and he other Part to the Aſtragal whoſe Liſt is $\frac{1}{3}$ of the whole.

According to *Vignola* and *Ser- io*, the *Ionic* Pedeſtal is ſix Mo- ules high; according to *Sca- mozzi*, Five; in the Temple of *Fortuna Virilis*, it is ſeven Mo- ules twelve Minutes.

Its Members and Ornaments re moſtly the ſame with thoſe f the *Doric*, only a little richer.

The Pedeſtal now uſually ollow'd is, that of *Vitruvius*, ltho' it is not found in any Work of the Antique.

Some, inſtead of it, uſe the *Attick* Baſe in Imitation of the Antients.

The Corinthian Pedeſtal. Vitruvius divides the whole Height of this Column into Nine Parts, and makes the Height of this Pedeſtal two of hoſe Parts.

The whole Height of the Baſe being divided into five Parts, the wo lowermoſt of them go to the *Plinth*; then the Remainder s again ſubdivided into four Parts; the lowermoſt of which oes to the *Thorus*; and the wo next Parts make the *ſcima reverſa*, and the Liſt below it, which Liſt is $\frac{1}{5}$ of the whole; he remaining Part goes to the Aſtragal, the Liſt of which is Part.

The Height of the Capital is divided into two Parts, the low- ermoſt of which being ſubdivid- ed into four Parts, the lower- moſt of thoſe go to the *Ogee*. The other three Subdiviſions being again ſubdivided into two Parts, the lowermoſt of thoſe goes to the *Scotia* or *Hollow*, and the Liſt above it, which Liſt is $\frac{1}{3}$ Part of the whole, and the remaining Part goes to the Boul- lin.

The other Grand Diviſion is alſo ſubdivided into three Parts, of which the two lowermoſt go to the *Corona*, and the remain- ing Part to the *Cymatium*, the *Liſt* of which is $\frac{1}{3}$ of the whole.

The *Corinthian Pedeſtal* is the richeſt and moſt delicate. In *Vignola*, it is ſeven Modules high; in *Palladio* five Modules one Minute. *Vignola* makes it ſeven Modules high; in *Palla- dio* five Modules one Minute; *Serlio* ſix Modules fifteen Mi- nutes: it is in the *Colliſeum*, four Modules two Minutes.

Its Members, according to *Vignola*, are as follows; in the Baſe are a *Plinth* for a *Socle*, over that a *Tore* carv'd; then a *Reglet*. A *Gula* inverted and in- rich'd; and an *Aſtragal*.

In the Die are a *Reglet*, with the *Conge* over it, and near the *Corniche* a *Reglet* with a *Conge* underneath.

In the *Corniche* is an *Aſtra- gal*, a *Frieze*, *Fillet*, *Aſtragal Gorge*, *Talon* and a *Fillet*

The Compoſite. Pedeſtal Vitru- vius divides the whole Height of this Column into thirteen Parts, making the Height of its Pedeſtal three of thoſe Parts.

The Base he divides into 7 Parts, two of which go to the *Plinth*, one to the *Thorus*, two to the *scima reversa*, one to the *Scotia*, and one to the *Astragal*; ⅓ of the *Astragal* makes the *Fillet* above the *Scotia*.

The Capital he divides into seven Parts, one of which goes to the *Astragal*, two to the *Frieze*, one to the *Boultine*, and List under it; two to the *Corona*, and one to the *Cymatium*.

Vignola makes the *Composite Pedestal* of the same Height with the *Corinthian*; *viz.* seven Modules, *Scammozzi* six Modules 2 Minutes; *Palladio* six Modules seven Minutes. In the Gold-Smith's Archs, seven Module eight Minutes.

Its Members in *Vignola* are the same with those of the *Corinthian*; but with this Difference, that whereas these are most of them inrich'd with Carvings in the *Corinthian*, they are all plain in the *Composite*.

And there is also a Difference in the Profiles of the Base and Corniche in the two Orders.

Daviler observes, that the Generality of Architects use Tables or Pannels either in *Relievo* or *Creux*, in the Dies of Pedestals; without any Regard to the Character of the Order.

Those in *Relievo*, he observes, are only suitable to the *Tuscan* and *Doric*; the three others must be indented, which he says, is a Thing the Ancients never practis'd, as being contrary to the Rules of Solidity.

PEDESTAL of the *Ionic* Or-der. The Height of this Pe-destal, according to this gene-ral Rule already propos'd should be one third of th Shaft of the Column; that i it should exceed 4 Modules 2 Minutes: Yet M. *Le Cler* says he makes it five Minute more; without which, in hi Opinion, it would lose all it Beauty; whence says he, i may be observ'd, that genera Rules are not always to be ri-gidly follow'd.

The Breadth of the Pedest he means that of the Die, is al-ways, he says, equal to th Breadth of the Plinth of th Column; excepting the Pede-stal be without Base and Cor-nice, as it frequently happen In which Case it is necessar that it should be a small Mat-ter broader, in Order to distin-guish it from the Base of th Column.

He usually allows one Mo-dule for the Height of the Ba of the Pedestal, and half Module for that of the Cor-nice; the Breadth of the Plint of the Column, always deter-mines that of the Die of th Pedestal; and a third of th Height of the Column, is th Measure for the whole Heigh of the Pedestal; so that th Difference in Height, betwee the, Pedestals of his Order lies wholly in their Dies.

M. *Le Clerc*, proposes tw kinds of Cornices for the *Pe-destal* of the *Ionic* Order; th one camus and solid, to be us' within Sides of Apartment where the Pedestal is to b view'd

w'd from above: The other s a Larmier, and is intended those Pedestals, whose Cor- es are above the Eye, and e to be view'd from below.

He observes, that were an *ragal* to be plac'd under- th the Cornice of the Pe- al, he gives in his 41 Fi- e, as is done in that of his *inthian*, there should be no ble in the Die; at least if any particular Reason there e requir'd one, there must no *Astragal*.

Nor would I, says he, ever w an Astragal under a Cor- , that is camus, and with- a Larmier, but a Table low'd in the Manner of half Pedestal.

Table under the Astragal ld make too many little ldings one over another; the Projecture of an As- l under a Cornice without rmier, would make it ap- too camus; whereas the eat of a Table will give Grace, and seem to aug- its Projecture, and render s camus.

hen Columns are to be d two by two, as it is times found necessary, the ar placing of the Tri- s in the inner Angle must little interrupted, in Or- keep up the Regularity e Parts of the Ceiling, stead of a little Part of a yph in the Angle, may be some suitable Ornament ver the Defect, as the of a Family, &c.

are PEDESTAL, is one Height and Width are equal; as that of the Arch of the Lions at *Verona*, of the *Corinthian* Order; and such some Followers of *Vitruvius*, as *Serlio*, *Philander*, &c. have given to their *Tuscan* Orders.

Double PEDESTAL, is that which supports two Columns, and has more Breadth than Height.

Continued PEDESTAL, is one which supports a Row of Columns without any Break or Interruption; as those are which sustain the fluted Columns of the Palace of the *Tuilleries*, on the Garden Side.

PEDESTALS *of Statues*, are such as serve to support Statues or Figures.

Vignola has observ'd, that there is no Part of Architecture more Arbitrary, and in which more Liberty may be taken, than in the Pedestals of Statues; there being no Rules or Laws prescrib'd by Antiquity, nor any settled, even by the Moderns.

There is no settled Proportion for these *Pedestals*; but the Height depends on the Situation and the Figure that they sustain; but yet when on the Ground, the *Pedestal* is usually two thirds, or two fifths of that of the Statue; but the more massive the Statue is, the stronger the Pedestal must be.

Their Form and Character, &c. are to be extraordinary and ingenious, far from the Regularity and Simplicity of the Pedestals of Columns.

The same Author gives a great Variety of Forms, Oval, Triangular, Multangular, &c.

The Base he divides into 7 Parts, two of which go to the *Plinth*, one to the *Thorus*, two to the *scima reversa*, one to the *Scotia*, and one to the *Astragal*; ½ of the *Astragal* makes the *Fillet* above the *Scotia*.

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PEDESTAL of the *Ionic* Order. The Height of this Pedestal, according to this general Rule already propos'd, should be one third of the Shaft of the Column; that is it should exceed 4 Modules 20 Minutes: Yet M. *Le Clerc* says he makes it five Minutes more; without which, in his Opinion, it would lose all its Beauty; whence says he, it may be observ'd, that general Rules are not always to be rigidly follow'd.

The Breadth of the Pedestal he means that of the Die, is always, he says, equal to the Breadth of the Plinth of the Column; excepting the Pedestal be without Base and Cornice, as it frequently happens. In which Case it is necessary that it should be a small Matter broader, in Order to distinguish it from the Base of the Column.

He usually allows one Module for the Height of the Base of the Pedestal, and half Module for that of the Cornice; the Breadth of the Plinth of the Column, always determines that of the Die of the Pedestal; and a third of the Height of the Column, is the Measure for the whole Height of the Pedestal; so that the Difference in Height, between the, Pedestals of his Orders lies wholly in their Dies.

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PEDESTALS *of Statues,* are ſuch as ſerve to ſupport Statues or Figures.

Vignola has obſerv'd, that there is no Part of Architecture more Arbitrary, and in which more Liberty may be taken, than in the Pedeſtals of Statues; there being no Rules or Laws preſcrib'd by Antiquity, nor any ſettled, even by the Moderns.

There is no ſettled Proportion for theſe *Pedeſtals;* but the Height depends on the Situation and the Figure that they ſuſtain; but yet when on the Ground, the *Pedeſtal* is uſually two thirds, or two fifths of that of the Statue; but the more maſſive the Statue is, the ſtronger the Pedeſtal muſt be.

Their Form and Character, *&c.* are to be extraordinary and ingenious, far from the Regularity and Simplicity of the Pedeſtals of Columns.

The ſame Author gives a great Variety of Forms, Oval, Triangular, Multangular, *&c.*

PEDIMENTS, ſays M. *Le Clerc*, are the Crowning frequently ſeen over Gates, Doors, Windows and Niches, and ſometimes over intire Orders of Architecture. The Ridges of ordinary Houſes were what gave Architects the firſt Idea of this noble Part.

The Parts of the Pediment are the *Tympanum* and its *Cornice*.

By *Tympanum* is meant the Area or Space included between the Cornice which crowns it, and the Entablature which ſupports and ſerves it as a Foundation.

The *Tympanum* is either triangular or circular; the Triangular, the Workmen call Pointed, and the Circular, Arch'd.

He obſerves, that the naked of a Pediment, *i. e.* the *Tympanum*, ought always to ſtand perpendicularly over the Frieze of the Entablature underneath.

2. That the Modillions of the Cornice of the Pediment ought to be found in the ſame Perpendicular, with thoſe of the Entablature underneath.

3. That Part of the Corniche on which the Pediment ſtands, beginning juſt at the Angle of the Corniche, as one would imagine it ſhould, it would be conſiderably widen'd, by Reaſon that that Angle is acute. But this would be a conſiderable Eye Sore; both on Account of the Inequality of its Width, and becauſe it would be rendred too ſtrong and heavy for the Corona.

Some Architects, to reduce this Cymatium to a proper Width, make the horizonta Cymatium that ſupports th two Sides of the Pediment ver flat; but this is to prevent on Deformity, by putting anothe in its Stead.

Other Architects make little Retreat or Elbow, as th Workmen call it, at the Extre mity of the *Cymatium* of th Pediment; which Expedien he thinks, is preferable to a of the reſt.

Sometimes the Pediment do not commence from the Extr mity of the Corniche; but that Caſe too there are Difficu ties.

Vitruvius obſerves, that t Ancients did not approve Modillions in the Corniche a Pediment; and the Rea they gave for it was, that M dillions being only intended repreſent the Ends of Rafte it would be abſurd to uſe th in the Declivity of a Pedime where no Rafters are ſupp to be.

But the Truth in thoſe M dillions are rather Orname to ſuſtain the great Proje of the *Corona* or *Larmier*, t to repreſent the Ends of Rafters or Pieces of Wo and therefore it would b Weakneſs to be influenc'd ſuch imaginary Reaſons; rather, becauſe theſe O ments have a very good Ef eſpecially when us'd in l Pediments.

M. *Le Clerc* obſerves, th triangular Pediment may to crown three Arches, b circular Pediment can't perly crown more than

nd the Centre of the Sweep of he Gate or Arch, ſhould be ſ'd for deſcribing the Sweep f the Pediment.

He would not have more han two Pediments plac'd over ach other in the ſame Front of Building; and even where here are two, it would not be miſs to have the one with a weep, and the other pointed r triangular; this laſt finiſh- g the Front in manner of a idge.

He alſo obſerves, that now e uſe none of thoſe broken nd interrupted Pediments, hich *Michael Angelo* intro- uc'd in his Time; nor is there ny Body that ſeems to value em, but People of no Taſte r Experience.

Thoſe made of latter Days, nd which are ſupported by n Entablature, truncated in e middle, as thoſe in the ourt of the *Val de Grace*, ere ſo maim'd to ſhew the ypher of the Houſe. But eſe are alſo Corruptions in rchitecture, which ought by l Means to be avoided.

He alſo obſerves, that tho' e Pediment is bounded by s *Tympanum* and its *Cornices*, t were it not for its Entabla- re underneath, it would not ly be ill ſupported, but im- rfect too; juſt as a Ridge ould be, if the Rafters that mpoſe it, wanted Beams, to event their flying aſunder.

The placing of two Pedi- ents over one another, as is ne in the old *Louvre*, is per- ctly abſurd and ridiculous, o' perform'd by an Architect Reputation.

In ſome Places we likewiſe ſee the Architrave interrupted and cut off between the two Columns with Feſtoons in its Place, which is a Deformity, tho' ſomewhat leſs conſiderable than the former.

He alſo remarks, that *Vitruvius* thinks it juſt, that all the Parts rais'd above Columns and Pilaſters, that is, all that are above the Eye, as the Faces of the *Architrave*, the *Frieze* the *Tympanum* of the *Pediment*, the *Acroteria* with their Figures or Statues, ſhould be inclin'd forward, about a twelfth Part of their Height. And his Reaſon for it is, that thoſe Parts will by that Means be the better expos'd to the View of ſuch Perſons who are plac'd below; but he thinks his Advice ought here to be ſet aſide, as being built on a particular Reaſon, to the Prejudice of a general Rule, which enjoins all the Parts of a beautiful Building to be exactly perpendicular. Without this, he ſays, they muſt needs have a woful Effect, when view'd Sideways; on which they would appear Reeling, and ready to tumble down.

However, Statuaries obſerve *Vitruvius*'s Maxims very judiciouſly, with reſpect to their Figures, when they are plac'd ſufficiently high, and can only be view'd in Front, and from below.

PEER } PIER } [in *Building*] is a maſſive of Stone, &c. oppos'd by Way of Fortreſs againſt the Force of the Sea, or a great River; for the Security of Ships that lie at

Harbour in any Haven, as *Dover Peer*, the *Peer* at great *Yarmouth*, &c.

PEERS [in *Architecture*] are a kind of Pilasters or Buttresses, rais'd for Support, Strength, and sometimes for Ornament.

Peers, are a Sort of square Pillars, part of which is hid within the Wall; the only Thing wherein it differs from a Pilaster, being this, that the latter has a Base and Capital, which the former has not.

The Scantlings or Size of Peers.] The Scantlings of Stone Peers, set down by Act of Parliament for the rebuilding of the City of *London*, after the Fire in 1166, (which Scantlings were well consider'd by able Workmen, before they were reduc'd into an Act) to be as follows, *viz.* in the first Sort of Houses, *Corner Peers* 18 Inches square; *middle* and *single Peers*, 12 and 14 Inches; *Double Peers* between House and House, 14 and 18 Inches. In the second and third Sort of Houses, *Corner Peers* 2 Foot 6 Inches square; *middle* or *single Peers*, 18 Inches square; *Double Peers* between House and House, 14 and 19 Inches square.

The Price.] Peers are sometimes measured and rated by the Foot running Measure; but they are more commonly rated at so much *per* Piece, dearer or cheaper, according to their Size, Goodness of the Stuff, and Curiosity of Workmanship.

A Pair of Stone Peers with Seat Arches, four or five Foot wide, and 14 or 16 Foot high may be worth 40 or 50 Pounds.

A Pair of Rustick Peers of Stone, may be worth 12 or 1[illegible] Pounds, according to their Height and Substance.

Plain Peers, 8 or 10 Pounds; revail'd and Pilaster Peers, from 12 to 14 Pounds a Pair.

PELLICOIDES [in *Geometry*] a Figure in Form of a Hatchet.

PENDENTIVE [in *Architecture*] the whole Body of a Vault, suspended out of the perpendicular of the Walls and Bearing against the Arc-Boutants.

Daviler describes it as the Portion of a Vault between the Arches of a Dome, usually inrich'd with Sculpture; and *Felibien* takes it for the Plain of a Vault, contain'd between the Double Arches, the forming Arches and the Ogives.

The *Pendentives* are usually of Brick or soft Stone, but Care is to be taken that the Couches or Beds of Masonry be always laid Level and in right Lines proceeding from the Sweep whence the Rise was taken; the Joints too must be made as small as possible, to save the Necessity of filling them up with Wood, or of using much Mortar.

PENDULUM [in *Mechanicks*] is any heavy Body so suspended, as that it may Vibrate or Swing backwards and forwards about some fixt Point, by the Force of Gravity.

PENTADORON, a kind of *Bricks* so call'd, See *Bricks*.

PENTAGON [in *Geometry*]

Figure with five Sides and e Angles.

PENTANGLE [in *Geome-y*] a Figure having five An-es.

PENTASTYLE [in *Archi-ture*] a Building having five ows of Columns.

Such was the Portico begun the Emperor *Gallian*, and ich was to have been con-ued from the *Flaminian* Gate the Bridge *Milvius*, *i. e.* from *Porto del Populo*, to the *onte-mole*.

PERIDROME [in the an-nt *Architecture*] the Space, llery, Alley or the like in a *riptere* between the Columns d the Walls.

PERIPHERY [in *Geometry*] the circumference or bound- Line of a Circle, Ellipsis, rabola and similar Figures.

The Periphery of every Cir- is supposed to be divided o three hundred and sixty grees, which are again sub-ided each into sixty Minutes, Minutes into Seconds, &c.

PERIPTERE [in the an-nt *Architecture*] a Building compass'd on the Out-side th a Series of insulated Co-mns forming a kind of Isle all und.

Such were the *Basilick* of *tonine*, the *Septizon* of *Seve-*, the *Portico* of *Pompey*, &c.

The *Peripteres* were pro-ly Temples, which had lumns on all the four Sides, which they were distin-ish'd from the *Prostyle* and *phyprostyle*, the one of which no Columns before, and other none on the Sides,

M. *Perrault* observes, that *Periptere*, in the general Sense, is the Name of a Genus including all the Species of Temples, which have Portico's of Columns all around; whether the Column be Diptere or Pseudo-Diptere, or simply *Periptere*, which is a Species that bears the Name of a Genus, and which has its Columns distant from the Wall, by the Breadth of an Intercolumniation.

PERITROCHIUM [in *Mechanicks*] as *Axis in Peritrochio* is one of the six Mechanical Powers, or simple Machines contrived for the raising of Weights,

PERFECT *Numbers*, are such whose aliquot or even Parts joined together will exactly return the whole Number as 6 and 28, &c. For of 6 the half is 3, the third Part 2, and the sixth Part one; which added together, make 6, and it hath no more aliquot Parts in the whole Numbers; so 28, which has these Parts 14, 7, 4, 2 and 1 exactly return 28, which therefore is a perfect Number, whereof there are but 10 between 1 and 1000000000.

PERPENDICULAR [in *Geometry*] is a Line falling directly on another Line, or so as to make equal Angles on each Side call'd also a *normal Line*.

From the very Notion of Perpendiculars, it follows,

1. That Perpendicularity is mutual, *i. e.* if a Line be perpendicular to another, that other is also Perdendicular to the First.

2. That only one Perpendicular can be drawn from one Point in the same Place.

3. That if a Perpendicular be continued through the Line it was drawn Perpendicular to, the Continuation will be Perpendicular to the same.

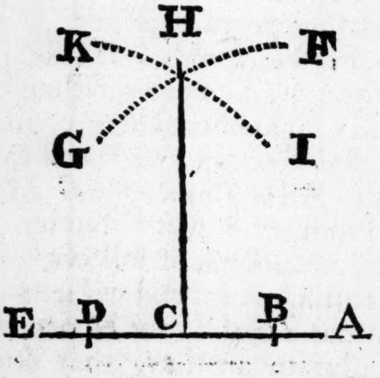
4. That if there be 2 Points of a Right Line, each of which is at an equal Distance from 2 Points of another Right Line, that Line is Perpendicular to the other.

5. That a Line which is *Perpendicular* to another, is also Perpendicular to all the Parallels of the other.

6. That a Perpendicular Line is the shortest of all those which can be drawn from the same Point to the same Right Line.

Hence the Distance of a Point from a Line, is a Right Line drawn from the Point *Perpendicular* to the Line or Plane; and hence the Altitude of a Figure is a *Perpendicular* let fall from the Vertex to the Base.

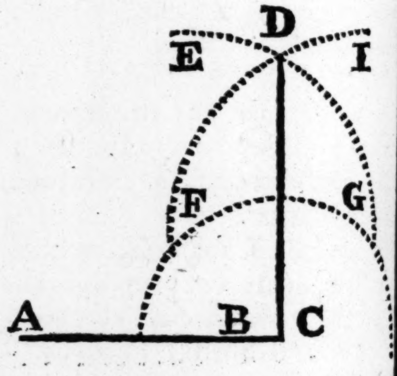
To erect the Perpendicular H, G, in or near the middle of the Right Line, A.



From the Point C set off any equal Distances to B and D; then with any opening Greate[r] than B C, on the Points B an[d] D describe the Arches F G and I K intersecting each othe[r] in H.

2*d*, Draw the Right Line H C and it is the Perpendicular re[-]quired.

To erect the Perpendicula[r] C D, from C the End of th[e] the Right Line, A C.

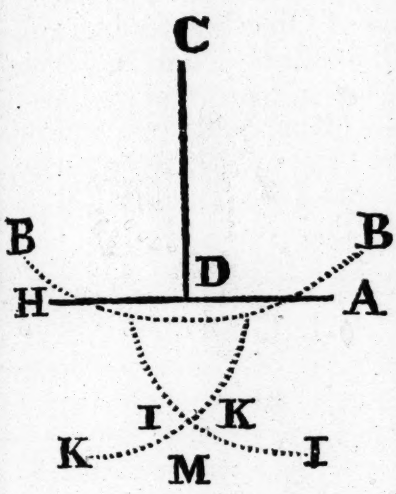


First, On C with any Open[-]ing of the Compasses describ[e] the Arch B F G H, and [l]the Opening as G B, from [B] to F, and from F to G; the[n] iwth the same, or a greater O[-]pening of the Compasses on t[he] Points F and G describe Arch[es] as F I, and G E, intersecti[ng] in D.

2*d*, Draw the Right Line [D] C, and 'tis the Perpendicul[ar] requir'd.

To let Fall the *Perpendicu[-]lar* from the given Point C [on] the Right Line A, H.

First, with an Opening of t[he] Compasses, greater than C, describe an Arch as B, B, int[er-]secting the Right Line A, in the Points G and N.



2*d*, With the Diſtance G N on G and N, deſcribe the Arches I I and K K, interſecting each other in M; then Draw the Right Line C M, and C D will be the Perpendicular let Fall, as requir'd.

PERPENDICULAR *to a Parabola*, is a Right Line cutting the Parabola, in the Point in which any other Right Line touches it, and is alſo it ſelf *Perpendicular* to that Tangent.

A Line is ſaid to be Perpendicular to a Plane, when it is *Perpendicular* to all the Lines it meets with in that Plain: and a Plane is *Perpendicular* to another Plane, when a Line in one Plane is *Perpendicular* to the other Plane.

PERRON [in *Architecture*] is a Stair-caſe lying open, or on the Outſide of the Building: properly the Steps in the Front of a Building, or raiſed before the Doors of great Houſes, which lead into the firſt Story, when raiſed a little above the Level of the Ground.

Perrons are made of different Forms and Sizes, according to the Space and Height they are to lead to.

Sometimes the Steps are Round and Oval; but more commonly Square.

PERRON, according to M. *Le Clerc*, is an Aſcent or Elevation given to the Elevation of a Building.

The Portail or Frontiſpiece of a Church, Palace or any other great Building, ſhould always have a Riſe of ſome Steps, that is in a Word, it ought to have a *Perron*.

The Reſt or Landing Place of a *Perron*, ſhould always be extended in width as far as the Frontiſpiece, if poſſible; and the Steps, according to *Vitruvius*, muſt always be an odd Number.

Theſe Steps ſhould always be five or ſix Inches in Height, and ten or twelve Inches in Breadth; that is, their Breadth muſt be Double their Height; which is found the beſt Porportion, to have an eaſy and common Aſcent.

Where a *Perron* is thirteen or fifteen Steps high; 'tis neceſſary, at leaſt 'tis Convenient, to interrupt its Range with one or two Landing Places, that there mayn't be too many Steps to Mount ſucceſſively, and that the Eye may not be diſpleaſed in Aſcending ſo great a Height without Reſts.

A *Perron* ſhould always be confined to the Height of the *Zocle* or Foot of the whole Building.

But tho' this *Zocle* or Foot ſerve as a continued Pedeſtal, yet

yet it must neither have a Base nor Corniche, when its Height is taken up by a *Perron*; and M. *Le Clerc* says he cannot agree with *Palladio*, in the Examples he has given to the contrary.

PERSIAN ORDER } [in PERSIC ORDER } *Architecture*] is an Order of Columns which has the Figures of *Persian* Slaves to support the Entablement instead of Columns, as the *Caryatic* Order has the Figures of Women for the same Purpose.

This Order was first used by the *Athenians*, on Occasion of a Victory obtain'd over the *Persians* by their General *Pausanias*, as a *Trophy* of this Victory, The Figures of Men drest according to the *Persian* Mode, with their Hands bound before them, and other Characters of Slavery, were charg'd with the Weight of *Doric* Entablatures, and made to do the Office of *Doric* Columns.

M. *Le Clerc*, says, that *Persian* Columns are not always made with the Marks of Slavery, but are frequently used as Symbols of Virtues and Vices, of Joy, Strength, Valour, &c. and even of Fabulous Deities made in the Figure of *Hercules*, to signify Strength; of *Mars*, to represent Valour; of *Mercury*, to represent Dexterity; and of Fauns or Saytrs, &c. to inspire Mirth and Jollity.

PERSPECTIVE, is an Art which teaches us the Manner of Delineating by Mathematical Rules; it shews us how to Draw Geometrically upon a Plane, the Representations of Objects according to their Dimensions, and different Situations, in such Manner, that the said Representations produce the same Effects upon our Eyes, as the Objects, whereof they are Pictures. Or

It is the Art of delineating visible Objects on a Plane Surface, such as they appear at a given Distance or Height, upon a transparent Plane, placed Perpendicular to the Horizon, between the Eye and the Object.

This is called particularly *linear Perspective*, as respecting the Position, Magnitude, Form, &c. of the several Lines or Contours of Objects, and expressing their diminution: this is opposed to *aerial Perspective*.

Aerial Perspective has Regard to the Colour, Lustre, Strength, Boldness, &c. of distant Objects, considered as seen through a Column of Air, and expresses the delineation thereof.

Perspective is imploy'd either in representing the Ichnographies, or Ground Plats of Objects, as projected on Perspective Planes, or in *Scenographies*, or Representations of the Bodies themselves.

The General Laws of each are subjoined; in Order to which it is necessary to premise the following *Lemmas* in *Perspective*.

1. That the Appearance of a Right Line, is ever a Right Line; whence the two Extremes being given, the whole Line is given.

2. That if a Line be Perpendicular

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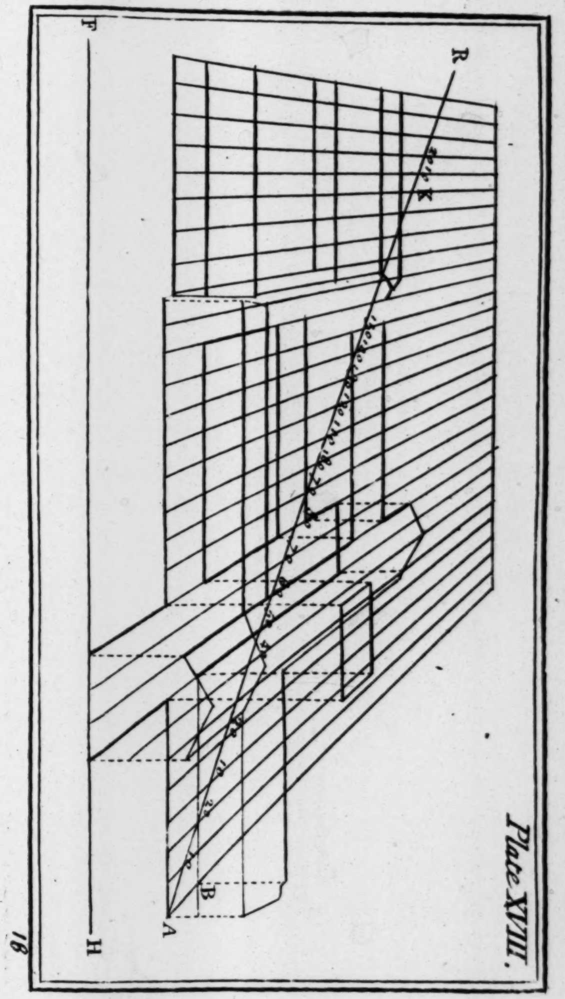


Plate XVIII.

18

icular to any Right Line drawn n a Plane, it will be Perpendicular to every other Right Line drawn on the same Plane.

3. That the Height of a Point appearing on the Plane, is to the Height of the Eye, as the Distance of the objective Point from the Plane, to the Aggregate of that Distance, and the Distance of the Eye.

PERSPECTIVE of BUILDING, &c.

In the Practice of the *Perspective* of Building, &c. Great Regard must be had to the Height of the horizontal Line, ll above the horizontal being en in the upper Part, and all bove it, in the under Part; hence Perspective becomes divided into the high and low ght, both which will be sufficiently illustrated by what llows.

To represent a Building (v. . Palace, College, &c.) *in erspective*. See the *Plate*.

1. Take the Ichnography or round Plot of the Building, Length, Breadth, and Depths, actual measuring, and take Altitude with a Quadrant.

2. Make a Scale divided into or 300 equal Parts, either ually, or so, as that each vision signifies ten Parts; by s Scale, lay down the Ground t.

When you have done this, ing a long Ruler and a are, which by sliding on a le, helps to draw your Perdicular easier, reduce it *Perspective*, in its Scenographick Appearance.

Then having drawn a Line towards the Bottom of the Paper, for the Front or Base Lines, as F L, divide it into as many equal Parts, as you find the Building have in the Ichnography, or more if you please. This will serve as a Scale to determine the several Heights, &c. and to these Divisions with a black Lead Pencil, draw Lines from the Centre when you have chosen it; which Choice requires Judgment upon two Accounts.

For if the Centre be too nigh the Front Line, then the Depth of the whole Building will fore shorten too much; and if too far off, it will not fore-shorten enough.

This may be illustrated thus, Set a Drinking Pot, or the like Vessel on a Stand, so that it be a little lower than your Eye, if you be at a great Distance from it, you can see very little or nothing into it; but if you come nigher to it by Degrees, you will perceive the farther Edge seem to be rais'd a little higher than that next to you, so that you may see a little Way into it; if you come very nigh it, you see deeper into it, and more than can well be exprefs'd in Picture.

You must therefore find some one Place which you conclude the most convenient for the Draught, and which may be in general determin'd to be as far off the Front Line, as the Front Line is long.

This Rule, tho' it has just Grounds, yet we sometimes dispense

dispense with it, *pro re nata*; that we may express Things with the better Appearance.

Consider how to place this Centre with such Advantage, that you may express those Things most, that you chiefly design to do; for as to the Bottom and Top Lines of the Sides of the Building that run from you in or nigh the direct Line to the Centre, tho' the upper Part is seen very well, yet the Sides that fall between the Ground Line and the Top, fall so very near one to the other, that it would be very difficult to express Particulars in them; so that the the Centre ought to be well chosen in regard to this.

Therefore those Buildings you would see most of, must be plac'd as far off as you see convenient from the direct Line that runs from the Centre, and the farther they are, the plainer they are. Then place those Things which you would have least seen, nighest to the direct Line; and observe whether the others fall according to your Mind; but this is to be done after you have drawn your Diagonal, which is the next Thing.

Having pitch'd on your Centre, and having drawn Lines from it to every Division of the Front Line, you must next determine your Diagonal A R, thus: Having measured the Front Line with a Pair of Compasses, set one Foot of the Compasses in the Centre, and take Notice where the other will reach in the Horizon (on both Sides if you please) and where it rests from that Point, draw a thwart Line from it to the last Division of the Front; and this will be truly drawn, or pretty nigh to the Truth.

That this is so, you may obseve how it falls in Respect of the two last Centre Lines; for if you draw a parallel, where the next Line from the last is intersected by the Diagonal, to the Front between them, as at A 10, you will have a *Rhombus*, if then all the Sides be pretty equal, you may be sure you are pretty nigh the right; but if the Sides which run towards the Centre, be too long, then Things will not fore-shorten enough; if the Sides be not long enough, then they will fore-shorten too much.

After you have thus divided the Front Line, fix'd the Centre, and plac'd the Diagonal, take the Breadth of the Chappel A B, which in the Ichnography is shewn to be 20 Parts; because this Line is perpendicular, it must run toward the Centre, therefore reckon 20 in the Diagonal, and the Rule being laid parallel to the Front in that Point, will give you a Point in the Centre Line, which will give the Breadth of the Chappel; and of Consequence, a Line drawn from A to B, puts it into the Ichnographick *Perspective*.

The Length of the Chappel being 70 Divisions in the Front Line, reckon 70 from B, parallel to the Front Line, and there you will have a Point at C.

The Depth of the Building from the Chappel, Northward, being 115 from the Chappel, you are to reckon from D, (where it cuts the Diagonal at 10) onwards in the Diagonal, with the Ruler as before, parallel in this Place in the Front, and there is found the Point Z, in the Central Line. The Breadth of it being 30, you reckon three Divisions, and the just Breadth is there, and so on every particular Part.

The Ichnography being thus plac'd into *Perspective*, you may then give every Thing its proper Height, thus

The Height of the Chappel being 30, you are to reckon 30 on the Front Line, and to drop a perpendicular to that Height by a Square clapt to the Front Line; and so where the other Side of the Chappel is plac'd, having reckon'd the Height upon the suppos'd Parallel, and there draw another Line in thatHeight; then joining these several Heights by several Lines, you will have the Profiles of each Building.

Now to diversify these several Lines, that they may not confound you, make the Ichnography, when you lay it into *Perspective*, in discontinued crooked Lines, the Heights, in prick'd Lines, and the Tops of each Building, in continued Lines, as the Centre Lines are in the Table.

You will also find the Centre, altho' it is not here express'd, as likewise the Point of Distance, by continuing the Diagonal up to the suppos'd Horizon, where it and the Eye is plac'd.

When these Things are done, you must employ your Art for the particular Expression of Things, by Drawing and Shadowing, which is the Life of this half form'd Figure, which is to be left to the Painter.

The *Low Sight* remains to be spoken of: Here the Horizontal is suppos'd just the Height of the Eye, about five Foot from the Basis; tho' 'tis generally plac'd higher, even to a third Part of the Height of the Building, that the Side Buildings may be express'd more gracefully.

The Diagonal is best determined by dividing the last Division of the Basis Line, into five Parts at G, taking four of these, sometimes the whole five, because it was before determin'd, that the Length of the Front Line, was the Distance of the Eye in the Horizon, to the Point of Distance: but here you are to take four, and then make this the Distance in the Horizon, between the Eye and the Point of Distance.

Then you may either graduate the Plan at the several Intersections of the Diagonal with the Centre Lines, or else suppose it so; and then raise the Building, as you will find by *Perspectives* enough of this Sort every where to be met with.

PERSPECTIVE is also us'd for a kind of Picture or Painting, frequently seen in Gardens, and at the End of Galleries; design'd expresly to deceive

deceive the Sight, by representing the Continuation of an Alley, a Landskip, a Building, or the like.

PERSPECTIVE *Plane*, is a Glass or other transparent Surface, suppos'd to be plac'd between the Eye and the Object, perpendicular to the Horizon, unless the contrary be expresly mention'd.

PHAROS } a Light House,
PHARE } a Pile rais'd near a Port, in which a Fire is kept burning in the Night, to guide and direct Vessels near at Hand.

PIAZZA [in *Architecture*] popularly call'd *Piache*, an *Italian* Name for a Portico.

It signifies a broad open Place or Square; whence it became apply'd to Walks or Portico's around them.

PIEDOUCH [in *Architecture*] is a little Stand or Pedestal, either long or square, inrich'd with Moulding; serving to support a Bust, or other small Figure.

PIEDROIT [in *Architecture*] is a Peer or a Kind of square Pillar, part of which is hid within a Wall: the only Thing wherein it differs from a Pilaster is, that the Pilaster has a regular Base and Capital, which the Piedroit wants.

PIEDROIT is also us'd to signify a Peer or Jaumb of a Door or Window; comprehending the *Chambranle*, *Chamfering*, *Leaf*, &c.

PILASTER [in *Architecture*] a square Column, sometimes insulated; but more frequently let within a Wall, and only shewing a fourth or fifth Part of its Thickness.

The Pilaster is different in different Orders, it borrows the Name of each Order, and has the same Proportions, and the same Capitals, Members, and Ornaments with the Columns themselves.

Pilasters are usually without swelling or Diminution, as broad at Top as at the Bottom; tho' some of the modern Architects, as M. *Mansard* &c. diminish them at Top, and even make them swell in the middle, like Columns, especially when plac'd behind Columns.

M. *Perrault* observes that *Pilasters* like Columns, become of different Kinds, according to the different Manner wherein they are apply'd to the Wall.

Some are wholly detach'd, these *Vitruvius* calls *Parastata*; others have three Faces clear out of the Wall; others two; and others only one; all these *Vitruvius* calls *Antæ*.

Insulate Pilasters are but rarely found in the Antique; the chief Use the Ancients made of Pilasters, was at the Extremities of Portico's, to give the greater Strength.

There are four Things to be principally regarded in *Pilasters*, *viz.* 1. Their Projecture out of the Wall. 2. Their Diminution. 3. The Disposition of the Entablature, when it happens to be common to them, and to a Column, and 4 their Flutings.

1. The *Projecture* of Pilasters,

ers, which have only one Face ut of the Wall, ought to be $\frac{1}{8}$ f their Breadth; or at most ot above $\frac{1}{6}$.

The Projecture may be a uarter of their Diameter when ey receive Imposts against eir Sides.

2. *Pilasters* are seldom di- inish'd when they have only e Face out of the Wall.

Indeed the *Pilasters* are to ve the same Dimensions with e Columns, where they stand the same Line with Columns d the Entablature is conti- ed over both without Break; at is to say, on the Face re- ecting the Column; the des being left without Dimi- tion.

3. *Pilasters* are sometimes ted, tho' the Columns that ey accompany are not; and the contrary, the Columns sometimes fluted, when the lasters that accompany them, not.

The Flutings of *Pilasters* always odd in Number, ex- pt in half Pilasters, which et at inward Angles, where r Flutings are made for ee, &c.

4. The Proportions of the pitals of *Pilasters* are the e as to Height with those Columns; but differ in eadth, the Leaves of *Pila- s* being much broader, be- se that *Pilasters* having e- l Extent, have only the e Number of Leaves for ir Girt, &c. *viz.* eight.

Their ordinary Disposition o have two in each Face in lower Row, and one in the middle in the upper Row, and two halves in the Angles, in the Turns of which they meet.

To this may be added; that the Run of the Vase or Tambour, is not strait, as the lower Part is; but a little circular and prominent in the middle.

In Pilasters which support Arches, *Palladio* shews, that the Proportions must be regulated by the Light they let in; and at Angles, by the Weight they sustain.

Sir *Henry Wootton* tells us, as to their Sight and Situation, that *Pilasters* must not be too tall and slender, least they resemble Pillars; nor too dwarfish and gross, least they imitate Piles or *Peers* of Bridges.

That Smoothness does not so naturally become them as a Rustick Superficies; for they aim more at State and Strength than Elegancy.

That in private Buildings, they ought not to be narrower than $\frac{1}{3}$, nor broader than $\frac{2}{3}$ of the Vacuity, or inter Space, between Pilaster and Pilaster; but as for those that stand at the Corners, they may have a little more Latitude allow'd them, by Discretion for the Strength of the Angles.

Palladio observes, that in Theatres and Amphitheatres, and such massive Works, they have been as broad as the half, and sometimes as the whole Vacuity or Interspace.

He also takes Notice (and others agree with him) that their true Proportion should be an exact Square, but (for lessening of Expence, and enlarging

of

of Room) they are usually made narrower in Flank than in Front.

Their principal Grace consists in half or whole Pillars, apply'd to them, in which Cases, Authors have well observ'd that the Columns may be allow'd Something above their ordinary Length, because they lean to so good Supporters.

As to the Price of *Pilasters*, They are sometimes measured and rated by the Foot running Measure, and valued at so much *per* Piece, according to the Size, Goodness of the Materials, and Curiosity of the Workmanship.

PILASTER *Bricks*, See *Bricks*.

PILASTERS are square Columns, as big at Top as Bottom.

These Pilasters are often us'd for mere Show; as when they appear inserted or let within the Wall, not discovering above a fifth or sixth Part of their Bigness.

These kinds of Pilasters, which may be call'd flat Pilasters, are always found to have a better Effect than others, which being intire, ordinarily appear heavy and lumpish.

When these Pilasters accompany Columns, they should have the same Heights with the Columns in every Part; but if they be alone, *i. e.* if they be not accompanied with any Columns, their Measures and Proportions should be varied.

First, In the *Roman*, *Spanish* and *Corinthian* Orders, the Capitals of Pilasters to be we[ll] proportioned should be highe[r] than those of Columns, as be[ing] broader; whence it follow[s] that their Shafts ought also [to] be augmented in Proportion.

Secondly, It may be observ'[d] in general, that a Pilaster mad[e] according to the Measures o[r] Proportions of a Column, tha[t] is, containing an equal Num[ber] of Modules in Height, ap[pears] much shorter with Re[gard] to its Breadth than th[e] Column; and the Reason i[s] that the Sides of the Pilaster being flat, appear in their fu[ll] Breadth; which is otherwise i[n] the Column, the Shadow o[f] whose Roundness makes it ap[pear] slenderer than it really i[s]. So that to make a Pilaster ap[pear] with the Beauty of a Co[lumn], the Height of its Sha[ft] must be augmented, as well [as] that of its Capital; and conse[quently] the Height of its En[tablature], and that of its Pede[stal], must be augmented like[wise].

Further, the Capital of [a] Pilaster being broader than th[at] of a Column, and the Profi[le] of the Entablature beyond th[e] naked of the Pilaster, contin[u]ing nearly the same, the M[o]dillions are found farther ap[art] from each other, than in th[e] Orders of the Columns, when[ce] it likewise follows that the D[i]stances given for the Interva[ls] of Columns adjusted by a ce[r]tain Number of Modillio[ns] won't serve for the Intervals [of] Pilasters, no more than th[ey] will for determining the P[ro]portion of Portico's.

And lastly, the Modillions eing farther a-part from each ther, the Cornice ought to ave a greater Projecture, in Order to have perfect Squares etween the Modillions, wherein the Regularity of the Soft depends.

'Tis necessary therefore, to ave particular Compositions or the Orders of Pilasters, distinct from those Columns; for his Reason says M. *Le Clerc* ppposes the following ones, which answer to those of his Order of Columns.

Of the Projecture of PILASTERS. He says, the ordinary Projecture of these Pilasters beyond the Wall, is 10 or 12 Minutes, but when they terminate the Saliant Angle of a Building, their Thickness, hould, if practicable, be reulated by the Parts of the Soffit or Plafond of the Corice.

When Flutings are us'd in Pilasters, their Number should be seven on each Side; the irst and last of which, may be little further from the Angle, hen the Rest are from each ther; that the Extremities of he Pilasters, mayn't be too uch weakened.

In some old Monuments we nd Pilasters which have only ve Flutings on a Side; but hen those are too large, and make the Pilasters appear little nd pitiful, and if there were ine, this would be too fine nd slender, even for the most elicate Orders.

He Remarks, that we never make Flutings in the *Tuscan* Pilaster, and if by Chance we make any in the *Doric* (which however is very rare) we leave pretty large Spaces next to the two Extremities in Order to fortify the Angles.

One may either add a single Fluting in the Projecture or Thickness of the Pilaster, or leave it quite plain, provided it don't exceed ten Minutes.

Pilasters split or cloven from Top to Bottom, M. *Le Clerc* says in an inner Angle, never have a good Effect; for besides that their halves have no Symmetry with the entire Pilasters that answer to them, their Capitals do likewise become very defective, as is particularly seen in the Church of the *Val de Grace.*

When Columns and Pilasters are plac'd under the same Entablature, the Entablature must be that of the Columns.

When Columns and Pilasters are plac'd under the same Entablature, they should never if possible stand in the Front Line, by Reason of the manifest Irregularities that would follow thereupon; they must therefore be separated by a Ressaut or Difference in the Range.

A Ressaut can never consist of less than an entire Modillion, without ruining the Regularity of the Parts of the Soffit or Cornice.

Further, if the *Ressaut* don't exceed a Modillion, the Column will remain engag'd in the Body of the Building.

When Pilasters accompany insulate Columns and serve them as a Ground or *arriere*

Corps, they ought to be at a competent Diſtance from each other, to prevent their Capitals from interfering.

When a Pilaſter is plac'd behind a Column, the Breadth of the upper Part of its Capital ſhould be reduc'd to that of the upper Part of the Capital of the Column, to the End that their Baſes being of the ſame Breadth, their *Abacus* and Volutes may be ſo too.

PILE [in *Antiquity*] was a Pyramid built of Wood, on which the Bodies of Perſons deceaſed were laid in Order to be burnt.

PILE is alſo us'd to ſignify a Maſs or Body of Building.

PILES [in *Architecture*] are great Stakes rammed into the Earth to make a Foundation to build upon in marſhy Ground.

Amſterdam and ſome other Cities, are wholly built upon Piles. The Stoppage of *Dagenham* Breach is effected by Dove-Tail *Piles* mortois'd into one another, by a Dove-Tail Joint.

PILLAGE [in *Architecture*] is ſometimes us'd by ſome Builders, for a ſquare Pillar ſtanding behind a Column to bear up the Arches; having a Baſe and Capital as a Pillar has.

PILLAR [in *Architecture*] is a kind of irregular Column, round and inſulated, deviating from the Proportions of a juſt Column.

Pillars are always either too maſſive or too ſlender for a regular Architecture; ſuch are the Pillars which ſupport *Gothic* Vaults or Buildings.

In Effect, *Pillars* are n[o] reſtrain'd to any Rules; th[e] Parts and Proportions being ar[-] bitrary.

PILLARS or PIEDROIT[S] of the *Roman* Order. In Po[r-] tico's where the Columns hav[e] Pedeſtals, the *Pillars* or *Pie-droits* ought to be four Modul[es] in Breadth; but if they b[e] more, M. *Le Clerc* ſays, th[ey] will be ill proportion'd to th[e] Columns; an Inſtance of whic[h] we have in the great *Compoſi[te]* Portico of *Palladio*; to whic[h] it may be added that the In[-] ter-Columns in that Caſe, woul[d] likewiſe be too big; as may b[e] obſerv'd in the *Doric* Order [of] *Vignola*, where the Pillars [of] his great Portico, being of fiv[e] Modules, the Columns a[re] found too far diſtant from on[e] another.

He alſo remarks, that *Pal-ladio* in the *Roman* Order ter[-] minates theſe Pillars with th[e] Mouldings of the Baſe of th[e] Pedeſtal, which he continu[es] quite round, ſo that the Ba[ſe] of the Pedeſtal, becomes con[-] founded with that of the Pie[-] droit; a Thing, that in hi[s] Opinion ought to be avoided.

For if thoſe Mouldings b[e] proportion'd to the Height o[f] the Pedeſtal, they can't be [ſo] to that of the Pillar: Beſide[s] that by advancing a good W[ay] within the Paſſage, they be[-] come incommodious, and ar[e] ſoon broken and defeated.

Vignola terminates theſe Pil[-] lars with a plain Zocle, whic[h] here ſuits very well.

When the Columns have n[o] Pedeſtals, he terminates th[e]

Pillar[s]

llars with a Zocle, equal to e Baſe of the Column.

A *Butting* Pillar is a ttreſs or Body of Maſonry, ſ'd with a Deſign to prop or ain the ſhooting of a Vault, ch or other Work.

A *Square* Pillar, is a maſ- e Work of Maſonry, call'd a *Peer* or *Piedroit*, ſerv- to ſupport Arches, &c.

PINION [in *Mechanicks*] is Arbor or Spindle, in the ly whereof are ſeveral In- tures or Notches, which h the Teeth of a Wheel, ſerves to turn it round, or *Pinion* is a leſſer Wheel, ch plays in the Teeth of a er.

INNACLE [in *Architec-*] is the Top or Roof of a iſe, which terminates in a nt.

his Sort of Roof among Ancients was appropriated emples; they making their nary Roofs flat, or in the form Way.

he *Pediment* is ſaid to have n its Riſe from the Pin- .

NNING [with *Bricklayers*] e faſtening of Tiles toge- with Heart of Oak, for Covering of a Houſe, &c. ing is ſaid by ſome *Suſſex* kmen, to be done for 8 *d*. 000, for finding Pins and ng of Tiles; but for the kmanſhip only 6 *d*.

NS *for Tileing*. It is cu- ry to allow two Gallons of Pins to every Thouſand les. Theſe Pins Mr. *Ley-* ſays, are in Price from 6*d*. the Gallon.

Others ſay that they uſe a Gallon of Pins to a ſquare and half of Tileing.

PIPES [in *Building*, &c.] Canals or Conduits for the Conveyance of Water, &c.

Pipes for Water, Water Engines, &c. are uſually of *Lead*, *Iron*, *Earth*, or *Wood*; thoſe of Timber, are ordinarily either Oak or Alder.

Iron Pipes are caſt in Forges; their Length is about two Foot ½, ſeveral of which are pieced together by Means of four Screws at each End, with Leather or old Hat between them to ſtop the Water.

Earthen Pipes are made by Potters. Theſe are fitted into one another, one End being always made wider than the other. To join them the cloſer and prevent their leaking, they are covered with Tow and Pitch, Their Length is commonly about two Foot ½.

The wooden Pipes are Trees bored with large Iron Augurs of different Sizes, beginning with a leſs, and then proceeding with a larger ſucceſſively; the firſt being pointed, the Reſt form'd like Spoons, increaſing in Diameter from one to ſix Inches: they are fitted into the Extremities of each other; and are ſold by the Foot.

Leaden Pipes are of two Sorts, the one ſoldered, the other not ſoldered; for the Conſtruction of each Sort, See *Lead* and *Plumbery*.

PISTON is a Part or Member of ſeveral Machines, as Pumps, &c.

The *Piston of a Pump*, is a ſhort Cylinder of Metal fitted exactly to the Cavity of the Barrel or Body; and which being work'd up and down alternately in it, raiſes the Water, and when rais'd, preſſes it again, ſo as to cauſe it to force up a Valve, with which it is furniſh'd, and ſo eſcape thro' the Noſe of the Pump.

PITCH.

PITCH [in *Architecture*] is the Angle, a Gable End, and conſequently the whole Roof of a Building.

If the Length of each Rafter be ¾ of a Building, the Roof is ſaid to be *True Pitch*.

If the Rafters are longer, 'tis ſaid to be a *high* or *ſharp pitch'd* Roof; if ſhorter, which ſeldom happens, it is ſaid to be a *low* or *flat pitch'd* Roof.

PITCHING, the ſame as *Paving*, which ſee.

PIVOT [in *Building*] is a Foot or Shoe of Iron or other Metal, ordinarily conical or terminating in a Point; by Means of which a Body which is intended to turn round, bears on another, fix'd at Reſt, and perform its Turns or Circumvolutions.

Large Gates, &c. uſually turn on Pivots. The Ancients relate that they had Theatres in *Rome*, which would contain 80000 People, which yet turned on a ſingle Pivot.

PLACARD [in *Architecture*] is the Decoration of the Door of an Apartment, conſiſting of a *Chambranle*, crown'd with its *Frieze* or *Gorge*; and its Corniche ſometimes ſupported by Conſoles.

PLACE [in *Opticks*] or ... *tick* PLACE, is the Point ... which the Eye refers an Obj...

PLACE *Bricks*, See *Bri*...

PLAFOND } [in *A*...
PLATFOUND } *chi*...
ture] is the Ceiling of a Ro... whether it be flat or arch... lin'd with Plaiſter or Join... Work, and frequently enric... with Painting.

PLAFOND is alſo m... particularly us'd for the Bott... of the Projecture of the *L*... *mier*, of the Cornice, call'd ... ſo the *Soffit*.

PLAIN *Cornice*. See *Corn*...

PLAIN FIGURE [in *G*... *metry*] is a Plane Surface, f... every Point of whoſe Perim... ter, Right Lines may be dr... to every other Point in ... ſame.

PLAIN *Angle* [in *Geomet*... is an Angle contain'd under ... Lines or Surfaces, ſo call'd ... Contra-diſtinction to a ... Angle.

PLAIN *Triangle* [in *Tri*... *nometry*] is a Triangle incl... ed under three Right Line... Surfaces, in Oppoſition to ... ſpherical or mixt Angle.

PLAIN *Trigonometry*, is ... Doctrine of Plain Triang... their Meaſures and Proport...

PLAIN GLASS *Mir*... &c. [in *Opticks*] is a Glaſ... Mirror, whoſe Surface is ... or even.

PLAIN *Tile*. See *Tile*.

PLAIN SCALE, is a ... Ruler, either of Wood or B... whereon are gratuated ... Lines of Chords, Sines ... Tangents, Leagues, Rhu... &c. and is of ready U...

ſt Parts of the Mathema-
ks.

PLAIN *Table*, is an Inſtru-
nt u'sd in ſurveying of Land.

1. The Table it ſelf, is a
rallelogram of Wood, 14
hes and a half long, and
out 11 Inches broad.

2. A Frame of Wood fix'd
it, ſo that a Sheet of Paper
ing laid on the Table, and
e Frame being forc'd down
on it, ſqueezeth in all the
ges, and makes it lie firm
d even, ſo that a Plot may
conveniently drawn upon it.
Upon one Side of this Frame
ould be equal Diviſions for
awing Parallel Lines, both
g Ways and croſs Ways (as
caſion may require) over
e Paper; and on the other
de, the 360 Degrees of a
rcle, projected from a Braſs
ntre, conveniently plac'd on
e Table.

3. A Box with a Needle and
rd, to be fix'd with two
rews to the Table, very uſe-
l for placing the Inſtrument
the ſame Poſition upon every
move.

4. A three legg'd Staff to
pport it; the Head being
ade ſo as to fill the Socket
the Table, yet ſo as the
able may be eaſily turn'd
und upon it, when 'tis fix'd
the Screw.

5. An Index, which is a
ge Ruler of Wood (or Braſs)
the leaſt 16 Inches long,
d two Inches broad, and ſo
ick as to make it ſtrong and
m; having a ſloped Edge
ll'd the fiducial Edge) and
2 Sights of one Height (the one
of which has a Slit above and a
Thread below) to be ſet in the
Rulers, ſo as to be perfectly of
the ſame Diſtance from the fidu-
cial Edge.

Upon this Index it is uſual
to have many Scales of equal
Parts, as alſo Diagonals and
Lines of Chords.

By this Inſtrument the
Draught or Plan is taken upon
the Spot, without any future
Protraction or Plotting.

PLASTERING, ſome Work-
men in *Suſſex* ſay, that they
have for Lathing and Plaſtering
with Lome on both Sides, 3 *d.*
per Yard; but with white Lime
and Hair Mortar on both Sides,
4 *d. per* Yard.

Some tell us that at *Tun-
bridge Wells* they will do the
Plaiſtering of Walls (where
they plaſter over all the Tim-
ber) and Cielings, for 2 *s.* 10*d.*
per Square; and ſome ſay, they
have had it done for 2 *s.* 6 *d.*

Of Plaiſtering Ceilings.]
They have in *Suſſex* for Plaſter-
ing of Ceilings, Lathing and
finiſhing, 4 *d.* *per* Yard.

And in ſome Countries,
where they make their Plaſter
of Reed, Lime and Hair, they
perform the Workmanſhip ſin-
gly for 3 *d. per* Yard; but if
the Workmen find all Mate-
rials, 'tis worth 5 *d.* or 6 *d.*

*Plaſtering with rough Mor-
tar*, call'd *Rough Caſting.*] In
Kent they Rough caſt upon
old Loam-Walls, that is they
give them one Coat upon the
Loam of *Rough Caſt* or *Rough
Mortar*, tho' it be commonly

ſtruck ſmooth like Lime and Hair, for 3 ½ *d. per* Yard, Workmanſhip only.

But if the Wall be new, and Lathed and Plaſtered with Loam on both Sides, they have 4 *d. per* Yard for Workmanſhip.

But if the Rough Caſting be wrought in Flouriſhes, they have 8 *d. per* Yard for Workmanſhip ſingly; but if the Workman find all Materials, 'tis worth from 1 *s.* to 3 *s. per* Yard, according to the Goodneſs and Variety of the Work.

Of Plaſtering on Laths, in Imitation of Brick.] For this Sort of Work, the Plaſter is made of Powder of Bricks, ſharp Sand, Lime and ſome Red Oker.

Some of this Plaſtering will look like a Brick Houſe, ſo as to deceive Paſſengers paſſing by, and look well for 20, 30, or 40 Years. This Work is valued at 1 *s. per* Yard for Workmanſhip only.

Of Plaſtered Floors.] Mr. *Wing* ſays this Work is worth, (the Workman finding all Materials) 1 *s.* 4 *d. per* Yard; but the Workmanſhip only from 4 *d.* to 6 *d.*

Plaſter may be had at the Pits for 4 *s.* or 4 *s.* 6 *d. per* Load, or 40 Hundred Weight, which will lay about 40 Yards of Flooring.

Of White Waſhing.] With Size upon plaſtered Walls, is uſually reckon'd at 2 *d. per* Yard.

Of Meaſuring.] This is uſually computed by the Yard ſquare, as *Paving* is. See *Paving*. But you are to take Notice, that in meaſuring Partitions, if the Workman find Materials, the Doors and Windows being meaſured by themſelves, are deducted out of the whole; as is alſo ⅛ Part of the Reſt, for the Quarters in rendering Work.

But if the Workman does not find Materials, he does not commonly make any Allowance for them, the Trouble of cutting and fitting the Laths being accounted equivalent to the void Spaces, left for the Doors and Windows.

Nor is there to be made any Allowance in Caſe of Workmanſhip only (in rendering) for the Quarters, Braces, or Interties, the Work being as much (if not more) than if it were all Plain. See *Pargeting.*

The Meaſuring of PLASTERERS *Work.*

PLASTERERS Works are chiefly of two Kinds.

1*ſt.* Lath'd and Plaſtered Work, which they call *Ceiling*.

2*dly.* Render'd Work which is of two Sorts, *viz.* upon Brick Walls or between Quarters, in the Partitions between Rooms, all which are meaſured by the Yard Square, or Square of 3 Feet, which is 9 Feet.

1*ſt.* Of *Ceiling.* If a Ceiling be 59 Feet, 9 Inches long, and 24 Feet 6 Inches broad, how many Yards are contain'd in that Ceiling?

Mult

Multiply 59 Feet, by 24 Feet, 6 Inches, and the Product will be 1463 Feet, 10 Inches, 6 Parts, which divided by 9, the Quotient will be 172 Yards, 5 Feet.

F.	I.	
59	9	
24	6	
236		
118		
209 :	10 :	6
18 :	00 :	0
1463 :	10 :	6

```
  59.75
   2415
  -----
  29875
 23900
11950
 ---------
9) 1463.875
Answer 162 : 5
```

By Scale and Compasses.

Extend the Compasses from to 59 Feet, 9 Inches, and that Extent will reach from Feet, 6 Inches, to 162.5. Yards.

2dly. Of Rendering.

Example. If the Partitions between Rooms be 141 Feet, 6 Inches about, and 11 Feet 3 Inches high, how many Yards do those Partitions contain?

Multiply 141 Feet 6 Inches, by 11 Feet 3 Inches, and the Product will be 1591 Feet, 10 Inches, 6 Parts; which being divided by 9, will give 176 Yards, 7 Feet, the Answer.

	F.	I.	
	141	6	
	11	3	
	1556	6	
	35	4	6
9)	1591	10	6
Answer	176 :	7	0

```
    141.5
    11.25
    -----
     7075
    2830
   1415
  1415
 -----------
9) 1591.875
 -----------
   176.87
```

Answer 176.87 Yards.

By Scale and Compasses

Extend the Compasses from to 141.5, and that Extent will reach from 11.25. to 176. Yards.

Note 1. If there are any Doors, Windows or the like in the Partitioning, Deductions must be made for them.

Note 2. That when *Rendering* upon Brick-Walls is measured, no Deductions are to be made; but when *Rendering* is measured between Quarters, one fifth Part may be very well deducted for the Quarters, Braces and Interties.

Note 3. Whiting and Colouring are both measured by the Yard, as *Ceiling* and *Rendering* were; and likewise in *Whiting* and *Colouring*, one fourth or at least one fifth Part is to be added; as one fifth Part is deducted in Rendering between Quarters.

PLAN, PLAIN, PLANE [in *Geometry*] is a *plain Figure* or Surface, lying evenly betwixt its bounding Lines. It is by *Wolfius* defin'd to be a Surface, from every Point of whose Perimeter, a Right Line may be drawn to every other Point in the same.

As the Right Line is the shortest Extent from one Point to another; so is a *Plane* the shortest Extension between one Line ond another.

Geometrical PLANE [in *Perspective*] is a Plane Surface, parallel to the Horizon, plac'd lower than the Eye, in which the visible Objects are imagined without any Alteration, except that they are sometimes reduc'd from a greater to a lesser Size.

Horizontal PLANE [in *Perspective*] is a Plane which is parallel to the Horizon, and which passes thro' the Eye, or hath the Eye suppos'd to be plac'd in it.

PLANE *of the Horopter* [i *Opticks*] is that which pass through the Horopter, and i perpendicular to the Plane o the optical Axes.

PLANE *Numbers*, is tha which may be produc'd by th Multiplication of two Num bers the one into the other thus 6 is a Plane Number, be cause it may be produc'd by th Multiplication of 3 by 2; likewise 15 is a Plane Numbe because it is produc'd by mu tiplying 5 by 3, and 9 is a Pla Number, produc'd by the Mu tiplication of 3 by 3.

PLANE PROBLEM [i the *Mathematicks*] is such one as cannot be solv'd Geom trically; but by the Intersecti either of a Right Line and Circle; or of the Circumferen of two Circles; as having th greater Side given, and th Sum of the other two, of Right angled Triangle, to fi the Triangle.

To describe a Trapeziu which shall make a given Ar of four given Lines, and fu a Right Line can cut a Circ or one Circle another; but two Points.

PLANE *of Reflection* [in C *toptricks.*] is that which pass through the Point of Reflecti and is always Perpendicular the Plane of the Glass or flecting Body.

PLANE *of Refraction*, i Surface drawn through the cident and refracted Ray.

PLANE *Surface*, is t which lie even between bounding Lines; and as Right Line is the shortest tens

tension from one Point to another, so a plain Surface is the shortest Extension from one Line to another.

Vertical PLANE, [in *Opticks* &c.] is a Plane Surface which passes along the principal Ray, and consequently through the Eye, and is Perpendicular to the Geometrical Plane.

Horizontal PLANE [in *Mechanicks*] is a Plane level or parallel to the Horizon.

Inclin'd PLANE [in *Mechanicks*] is a Plane which makes an Obique Angle, with an Horizantal Plain.

PLANE [in *Ioinery*, &c.] is an Edg'd Tool or Instrument for paring and shaving Wood smooth, even, &c.

It consists of a Piece of Wood very smooth at Bottom, as a Stock or Shaft; in the middle of which is an Aperture, thro' which a Steel Edge or Chissel placed Obliquely passes, which being very Sharp, takes off the inequalities of the Wood, it is slid along.

Planes have various Names according to their various Forms, Sizes and Uses.

1. The *Fore*-PLANE which is a very long one, and is usually that which is first used, the Edge of its Iron, or Chissel is not ground Streight; but Rises with a Convex Arch in the middle, to bear being set the ranker: the use of it being to take off the greater irregularities of the Stuff, and to prepare it for the smoothing Plane.

2. The *smoothing* PLANE is short and small, its Chissel or Iron being finer; its use is to take off the greater irregularities left by the *Fore-plane*, and to prepare the Wood for the Jointer.

3. The *Jointer* is the longest of all; its Edge being very fine, and not standing above a Hair's Breadth: It is used after the Smoothing Plane, and is chiefly designed for shooting the Edge of a Board perfectly strait, for jointing smooth Tables, &c.

4. *The Strike Block* is like the Jointer, but shorter: Its Use is to shoot short Joints.

5. *The Rabbet* PLANE is us'd in cutting the upper Edge of a Board, strait or square, down into the Stuff, so that the Edge of another, cut after the same Manner, may join in with it on the Square; it is also us'd in striking *Facia*'s in Mouldings. The Chissel or Iron of this Plane is full as broad as its Stock, that the Angle may cut strait, and it delivers its Shavings at the Sides, and not at the Top, like the others.

6. *The Plow*, a narrow Rabbet Plane, with the Addition of two Staves, whereon are Shoulders. The Use of it is to plow a narrow square Groove on the Edge of a Board.

7. *Moulding* PLANES; of these there are various Kinds, accommodated to the various Forms and Profiles of the Mouldings; as the *round Plane*, the *hollow Plane*, the *Ogee*, the *Snipes Bill*, &c. which are all of several Sizes, from half an Inch, to an Inch and half.

To

To uſe the *Moulding Planes* on ſoft Wood, as Deal, *&c.* They ſet the Iron to an Angle of 45, with the Baſe or Socle of the Plane. On hard Wood, as Box, *&c.* they ſet the Iron to an Angle of 80 Degrees, ſometimes quite upright.

To work on hard Wood, the Edge or Baſil is ground to an an Angle of 18 or 20 Degrees; to work on ſoft Wood, to an Angle about 12, for the more acute the Baſil is, the ſmoother the Iron will cut; but the more obtuſe, the ſtronger.

PLANIMETRY, is that Part of *Geometry* which conſiders Lines and Plain Figures; without any Conſideration of Heights or Depths.

The Word is particularly reſtrain'd to the meaſuring of Planes or Surfaces, in Oppoſition to *Stereometry*, or the meaſuring of Solids.

PLANO *Concave Glaſs* or *Lens*, is that, one of whoſe Surfaces is Concave, and the other Plain.

The Concavity is here ſuppos'd to be ſpherical, unleſs the contrary be expreſs'd.

PLANO *Convex Glaſs* or *Lens*, is that, one of whoſe Surfaces is Convex, and the other Plain.

The Convexity of this is ſuppos'd to be ſpherical, unleſs the Contrary be expreſs'd,

PLASTER } A Compoſi-
PLAISTER } tion of Lime ſometimes with Hair, ſometimes with Sand, *&c.* for Pargeting or Covering over the Nakedneſſes of a Building.

PLASTER *of Paris*, is a Foſſil Stone, of the Nature of a Lime-Stone, ſerving to many Purpoſes in Building, and is alſo us'd in Sculpture, in moulding and making of Statues, Baſſo Relievo's, and other Decorations in Architecture.

It is dug out of Quarries, in ſeveral Places near *Paris*, whence it takes its Name; the fineſt of it is that of *Montinartre*.

Crude PLASTER of *Paris*, is the Native as it comes out of the Quarry, in which State it is us'd, as Hards in the Foundation of Buildings.

Burnt PLASTER is the Native calcin'd like Lime in a Kiln or Furnace, pulveriz'd or diluted with Water or other Liquid in working it. In this State it is us'd as Mortar or Cement in Building.

It being well ſifted and reduc'd to an impalpable Powder, it is us'd in making Figures in Sculpture.

PLASTICE or *Plaſtic Art*, a Branch of Sculpture, being the Art of forming Figures of Men and other Animals, in Plaſter, Clay, Stuc, *&c.*

It is not only comprehended under Sculpture, but is indeed Sculpture it ſelf; but with this Difference, that the Plaſterer or *Plaſtee* (by his *Plaſtic Art*) makes Figures by Additions, but the Carver by Subtraction, whereupon *Michael Angelo* was wont to ſay (pleaſantly) that Sculpture was nothing but a Purgation of Superfluities; for take away from a Piece of Wood or Stone, all that is ſuperfluous, and the Remainder is the intended Figure.

The

The *Plastic Art* is now hiefly us'd among us in Fret-Work Ceilings; but the *Italians* apply it to the Mantlings f Chimneys with great Figures, a cheap Piece of Magnificence, and almost as durable within Doors, as harder Forms in the Weather.

PLAT-BAND [in *Architecture*] says M. *Perrault* is ny flat square Moulding, having less Projecture than Height; uch are the Faces or Fasciæ of n Architrave, and the *Plat-Bands* of the Modillions of a Cornice.

These *Plat-Bands* are ordinarily cross'd with Bars of Iron, when they have a great *Bearing*; but it is much better to ease them by Arches of Discharge built over them.

PLAT-BANDS *of Flutings* are the Lists or Fillets between the Flutings of the *Ionic*, *Corinthian* and *Composite* Columns, they are each in Breadth $\frac{1}{4}$ of the Flute.

Plat-Bands are also a square Moulding, set at the End of the Architrave of the *Doric* Order.

The *Plat-Band* is signified by *Vitruvius* by the Words, *Fascia*, *Tænia* and *Corsa*.

PLAT-FORM [in *Architecture*] is a Row of Beams which support the Timber Work of a Roof, and lie on the Top of the Wall, where the Entablature ought to be rais'd.

The Term is also us'd for a kind of Terras Walk or even Floor on the Top of a Building; from whence we may take a fair Prospect of the adjacent Country.

So an Edifice is said to be cover'd with a Platform when it is flat at Top, and has no arched Roof or Ridge.

Platform is sometimes us'd to signify the Ichnography or Draught of the Ground-Plot of an House.

Most of the Eastern Buildings are covered with *Platforms*, as also were those of the Ancients. *Cæsar* is said to have been the first among the *Romans* who obtain'd leave to build his House with a Ridge or Pinnacle.

PLATFOND is a *French* Word, us'd for the Ceiling or Roof of a Chamber or other Room. The same as *Soffit*.

PLATONICK BODIES, the same that are otherwise call'd *Regular Bodies*.

PLINTH [in *Architecture*] is a flat square Piece or Table in Form of a Brick (from πλινθος in Gr. signifying a Brick) under the Mouldings of the Bases of Columns and Pedestals.

It is us'd as the Foot or Foundation of Columns, seeming to have been originally intended to prevent the Bottom of the Primitive wooden Pillars from rotting.

The *Plinth of a Statue* is a Base or Stand, either flat, round or square, serving to support a Statue.

Plinth of a Wall is a Term us'd by Bricklayers for two or three Rows of Bricks, which advance out from the Wall, or it is us'd in the General for every flat, high Moulding, serv-

ing

ing in a Front Wall to mark the Floors, or to sustain the Eaves of a Wall, and the Larmier of a Chimney.

Vitruvius calls the *Tuscan Abacus* Plinth, on Account of the Resemblance it bears to a Brick: It is also call'd *Orlo*.

PLUMB LINE, a Name given by Artificers to a *Perpendicular*, it is thus call'd, because usually describ'd by Means of a Plummet.

PLUMBERY, See *Lead*.

PLUMMET, PLUMB RULE, PLUMB LINE, is an Instrument us'd by Carpenters, Masons, to draw Perpendiculars withal, in Order to judge whether Walls, &c. be upright Planes, horizontal and the like.

It is thus call'd from *Plumbum*, i. e. a Piece of Lead, fastened to the End of a Thread or Chord.

Sometimes the String descends along a wooden Ruler, &c. rais'd perpendicular on another; in which Case it becomes a Level.

POINT [in *Geometry*] is that which is suppos'd to have neither Breadth, Length nor Thickness; but to be indivisible.

1. The Ends or Extremities of Lines are Points.

2. If a Point be suppos'd to be mov'd any Way, it will by its Motion describe a Line.

POINT [in *Perspective*] is a Term us'd for various Parts or Places, with Respect to the Perspective Plane.

Objective POINT, is a Point on a Geometrical Plane, whose Representation is required on the Perspective Plane.

POINT *of Concourse*, POINT *of Concurrence* [in *Opticks*] is that Point where the visual Rays, being reciprocally inclin'd, and sufficiently prolonged, meet together, are united in the middle, and cross the Axis. This Point is most usually call'd the *Focus*, and sometimes the *Point of Convergence*.

POINT *of Dispersion*, is that wherein the Rays begin to diverge, which is usually call'd the *Virtual Focus*.

POINT *of Incidence* is a Point on the Surface of a Glass or other Body, wherein a Ray of Light falls; and as some express it, is that Point of a Glass from which a Ray parts after its Refraction, and when it is returning into the rare Medium again.

POINT *of View*, with Respect to Building, &c. is a Point at a certain Distance from a Building or other Object, wherein the Eye has the most advantageous View or Prospect of the same.

This *Point* is usually at a Distance equal to the Height of the Building, as for Instance. To examine with Judgment the whole of the celebrated Church of the *Invalids* at *Paris*, a Person must not stand at above 340 Foot distant from it, which is pretty near its Height.

To be able to judge of the Ordonnance of its Facade and Frontispiece, and the Regularity of its Order, the Eye should be as far off as the Fron-

Frontiſpiece is high, *viz.* 100 Foot.

But to examine the Correctneſs of its Profiles, and the Spirit of its Ornaments, the Eye ſhould only be diſtant the Height of the *Doric* Order, which is about 40 Foot; if it be nearer, the Parts being too much ſhorten'd, will appear out of Proportion.

A vague or indeterminate Point has a different Effect from the *Point of View*, in that, in looking at a Building from an indeterminate Point; the Eye can only form an Idea of the Magnitude of its Maſs, by comparing it with other Buildings adjacent to it.

POINT *of Reflection*, is a Point on the Surface of a Glaſs or other Body, whence a Ray is reflected.

POINT *of Refraction*, is a Point in the Surface of a Glaſs or other reflecting Surface, wherein the Refraction is effected.

POITRAL, See *Architrave*.

POLYGON [in *Geometry*] A term in the General ſignifying any Figure of many Sides and Angles, tho' no Figure is call'd by that Name, except it have more than four or five Sides.

If the Sides and Angles be equal, the Figure is call'd a Regular Polygon. Polygons are diſtinguiſh'd according to the Number of their Sides; thoſe of five Sides, are call'd *Pentagons*, thoſe of 6, *Hexagons*, thoſe of ſeven, *Heptagons*, thoſe of eight, *Octagons*, *&c.*

Euclid demonſtrates theſe which follow.

1. Every Polygon may be divided into as many Triangles as it has Sides.

2. The Angles of any Polygon taken together, will make twice as many Right ones, except 4, as the Figure has Sides.

3. Every Polygon circumſcrib'd about a Circle, is equal to a Rectangled Triangle, one of whoſe Legs ſhall be the Radius of a Circle, and the other the Perimeter or Sum of all the Sides of the Polygon.

POLYGRAM is a Geometrical Figure, conſiſting of many Lines.

POLYHEDRON [in *Geometry*] is a Body comprehended under ſeveral Faces or Sides; ſuch are all the five Regular Bodies.

POLYHEDRON [in *Opticks*] is a Glaſs or *Lens*, conſiſting of ſeveral plain Surfaces, diſpos'd into a Convex Form, popularly call'd a *Multiplying Glaſs*.

POLYHEDROUS FIGURE [in *Geometry*] is a Solid contain'd under, or conſiſting of many Sides, which if they are regular Polygons, all ſimilar and equal, and the Body be inſcribable within the Surface of a Sphere, 'tis then call'd a Regular Body.

POLYOPTRUM [in *Opticks*] a Glaſs through which Objects appear multiply'd, but diminiſh'd. It differs both in Structure and Phænomena.

POLYSCOPES or multiplying Glaſſes, are ſuch as repreſent to the Eye one Object as many.

PORCH [in *Architecture*] a

a kind of Vestible supported by Columns, much us'd at the Entrance of the ancient Churches.

In the ancient Architecture *Porch* was a Vestible or Disposition of insulated Columns, usually crown'd with a Pediment, forming a Covert Place before the principle Door of either a Temple or Palace.

When they had four Columns in Front, they were call'd *Tetrastyles*, when 6, *Hexastyles*; when 8, *Octostyles*; when 10, *Decastyles*, &c.

PORIME } [in *Geometry*]
PORIMA } is a Theorem or Proposition, so easy to be demonstrated, that it is almost Self-evident, as that a Chord is all of it within the Circle.

And on the Contrary, they call that an *Aporime*, which is so difficult as to be almost impossible to be demonstrated; as the squaring of any assign'd Portion of *Hippocrates*'s *Lunes* was till lately.

PORISTICK *Method* [in *Mathematicks*] is that which determines when, by what Way, and how many different Ways a Problem may be resolv'd.

PORPHYRY, a precious kind of Marble, of a brownish red Colour, frequently interspers'd with white Stains, anciently brought from *Egypt*, and exceeding all other in hardness.

The Art, which the Ancients had, of cutting *Porphyry*, seems to be intirely lost. And indeed it is hard to conceive what kind of Tools they must have us'd for fashioning of those large Columns, and other Works in Porphyry, found in the City of *Rome*.

One of the most considerable Pieces that now remains intire, is a Tomb of *Constantia*, Daughter of the Emperor *Constantine*, in the Church of St. *Agnes*, without the Walls; commonly call'd the Tomb of *Bacchus*, because of several Boys represented upon it playing among the Vine Leaves. And that of *Appollo*, and the Busts of 12 Emperors, all of *Porphyry*, in the Palace of the *Tuilleries*.

Some of the ancient Pieces seem to have been wrought with a Chissel, others with the Saw, others, with Wheels, and others ground by Degrees with Emery.

Yet the modern Tools will scarce touch *Porphyry*, so that it may be concluded, either that the Ancients had the Secret of tempering Steel better than we now have, or that as some imagine, they had the Art of softening the *Porphyry*. But it is rather more probable, that Time and the Air have contributed to increase its hardness.

Mr. *Addison* informs us, he saw a Workman in *Rome*, employ'd in the cutting of *Porphyry*; but his Advances were exceeding slow, and almost insensible.

The only Way the *Italian* Sculptors have of working the Pieces of old *Porphyry* Columns that are still remaining (for the *Porphyry* Quarries are long since lost) is with a Brass Saw

w without any Teeth. With is together with Emery and ater, they rub and wear it th infinite Patience.

Many Persons have endea-ured to retrieve the ancient t, particularly *Leon Baptista lberti*, who searching after e necessary Temper, tells us found Goat's Blood the best any; but yet even this a-il'd but little; for in work-g with Chissels tempered rein, Sparks of Fire came re plentifully than Pieces of e Stone.

By this Means Sculptors re able to make a flat or al Form; but could never ain to the making any Thing e a Figure.

It is indeed reported that *smo de Medici*, in the Year 55, distill'd a Water from tain Herbs, by the Help of ich his Sculptor, *Francisco dda* gave his Tools such an mirable Hardness, that he rform'd some fine Works th them; particularly our viour's Head in *Demi-Re-vo*, *Cosmo*'s Head, and his tchesses. Even the very ir and Beard, which were ry well done, how difficult ver it was; so that there is thing better in all the Works the Ancients: but the Se-t seems to have died with m.

The *French* have lately found t another Method of cutting *rphyry, viz.* with an Iron w without Teeth, and *Gres*, a kind of Free-Stone, pul-iz'd and Water.

The Authors of this Invention, pretend they could perform the whole Contour of a Column hereby, had they Matter to work on.

PORTAL, [in *Architecture*] a little square Corner of a Room, cut off from the rest of the Room, by Wainscot; frequent in the antient Buildings; but now disus'd.

It is also us'd for a little Gate, where there are 2 Gates of a different Bigness: It also sometimes signifies a kind of Arch of Joiners Work before a Door.

PORTAIL, [in *Architecture*] signifies the Face or Frontispiece of a Church, view'd on the Side, wherein the great Door is; Also the great Door of a Palace, Castle &c.

PORTICO, [in *Architecture*] is a kind of Gallery built on the Ground; or a Piazza encompass'd with Arches, supported by Columns, where People walk under covert.

The Roof is commonly vaulted. This was by the Antients call'd Lacunar.

Altho' the Word *Portico* be deriv'd from *Porta i. e.* a Gate or Door, yet it is apply'd to any Disposition of Columns which form a Gallery; without any immediate relation to Doors or Gates.

The most celebrated Portico's of Antiquity were those of Solomon's Temple, which form'd the *Atrium* and encompass'd the Sanctuary; that of *Athens*, built for the People to divert themselves in; and wherein the Philosophers held their Disputations and Conversations, which

which was the Occasion of the Greek *Stoicks* of στοα Gr. a *Portico*: and that of *Pompey* at *Rome*, erected merely for Magnificence; consisting of several Rows of Columns, supporting a Platform of vast Extent, a Design of which *Serlio* presents us with in his *Antique* Buildidgs.

Among the Modern *Portico's* the most celebrated is the *Piezza* of *St. Peter* of the *Vatican*; that of *Covent Garden*, the Work of *Inigo Jones*, is also much admired.

M. *Le Clerc* says, tho' we have but few Instances of *Arches* or *Porticos* supported by Columns, yet nothing hinders but that they may be us'd where the Architecture is not requir'd to be very strong, as in a plain open Gallery, serving for a Passage or Communication between two Parts of an House, or where 'tis desired to have a slight Terrass in the Front of a Building and a Gallery or Portico underneath.

In a Portico of this Kind, he would have nothing but the Archivolte upon the Column; the Corniche should be plac'd over the Archivolte.

PORTRAIT, PORTRAITURE, } [in *Painting*] the Representation of a Person and especially a Face done from the Life.

PORTLAND *Stone*, Slabs of *Portland* Stone (ready polish'd for Chimney Foot Paces) 1 *s*. 8 *d*. per Foot superficial. It is a Stone much us'd in Building, and much softer and whiter than *Purbeck*.

PORT-NAILS, see *Nails*.

POSTS, [in *Building*] pretty big Pieces of Timber, plac'd upright in Houses &c.

PRINCIPAL POSTS, are the Corner Posts of a House, and the Posts fram'd into Bressummers, between the principal *Prick-Posts* for strengthening the Carcass of a House.

A *Method* of *Preserving Posts*] It is a very excellent Method of preserving Posts from rotting, to burn the Ends of them that are to be set in the Ground.

POST and RAIL, see *Fencing* and *Paleing*.

POUND NAILS, see *Nails*.

POUDERINGS, [in *Architecture*] a Term sometimes us'd for Devices, in filling up vacant Spaces in carv'd Work.

PRICK-POST. see *Posts*.

POWERS, [in *Mechanicks*] is *whatever can move* a *heavy Body*, and is therefore call'd the *moving Force*, the Weight is a Power in Reference to a heavy Body, which it may move.

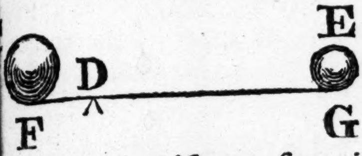
Power is twofold, that is either *animate* as the Power of Men, Horse &c, in pulling, drawing &c, or *inanimate*, as the specifick Gravity of a Body of Gold, Iron, Stone, Water &c, as one Pound two Pounds &c of Weight.

The Quantity of Power is estimated by the Quantity of Weight of the Body which it sustains, that is, when a Power sustains twice or thrice its own Weight; then we say that the Power is double or triple the Weight which it doth sustain.

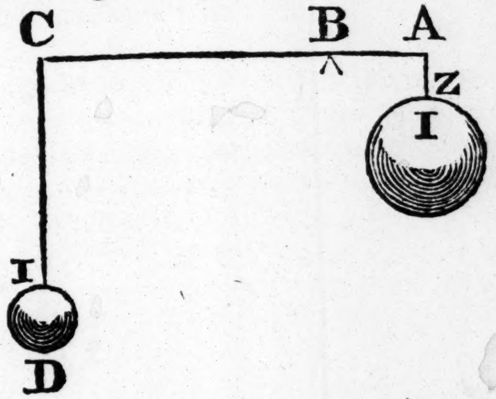
2. The Manner of applying a Power to a *Lever* may be immediatly on the *Lever*, as

Wei

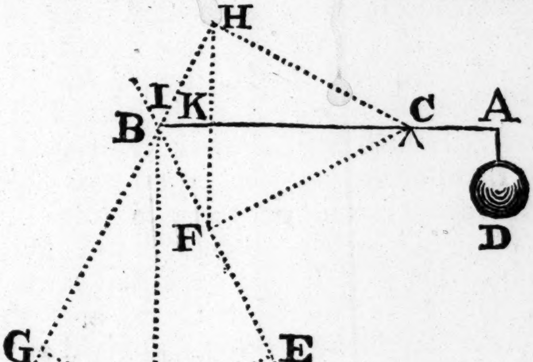
eight E laid on the End of
Lever G F.



Or at ſome Diſtance from it, the Weight D hung on the Point C, by Means of the Chord D C and that right Line in which a Power or heavy Body endeavours to move in, is call'd the Line of Direction of that Body: So C I is the line of Direction of the Body D, and A Z of the Weight I.



The real Application of a ower to a *Lever* is that An-, which is conſtituted by a ver and *Line of Direction* their Point of meeting: thus Angle A B E conſtituted by the line of Direction E B and the *Lever* A B is the Application of the Power E: So likewiſe are the Angles A B F and A B G Applications of the *Powers* F and G.



The Power F, which is ap-'d to the Lever B at Right gles, hath the greateſt Ef-, not only of the other two wers E and G, but of all ers that are not Perpendicular to the Lever A B.

The Proof.

1. The Diſtance of a Weight, or a Power from the *Fulcrum* is the neareſt Diſtance contain'd between the *Fulcrum* and the

the Line of Direction; that is, it is a Right Line or Perpendicular let fall from the *Fulcrum* upon the Line of Direction, as C F on the Line of Direction B E.

2. If you describe the Arch F B, on C, with the Radius C F, it is evident that C K is less than C B, and the Point K is nearer to the *Fulcrum* C than the Point B; and since that the farther the Power is apply'd from the *Fulcrum*, the greater Force it will have: Thence it is evident that the Power F, which acts upon the Part of the Lever B, must have greater Force than the Power E, whose Distance from the *Fulcrum* is = C K, which is less than C B.

But if it shall be suppos'd from hence, that the lesser the Angle of Application is, the greater the Power must be increas'd to become equal to the Power F, and that the greater the Angle of Application is made, as the Angle C B G, the lesser the Force is requir'd to be equal to the Power F.

I answer that the first Supposition upon the Powers apply'd with Angles acute is right; but the Supposition of the Obtuse Angles requiring a lesser Force to equalize F is false, which I shall prove as follows.

1. It has been said already, that the Distance of a Power from the *Fulcrum*, is a Right Line or Perpendicular, let fall from the *Fulcrum* upon the Line of Direction.

2. Since the Lever C B is the Perpendicular it self to the Line of Direction B F of the Power E, whose Angle C B F is a Right Angle, it is evident that if the Power F be remov'd to G, then the Angle C B G will be an obtuse Angle.

And seeing that when any Right-lin'd Triangle hath one of its Angles obtuse, the Sum of the other two must be less than a Right Angle; because the Sum of all the three Angles taken together, are always equal to two Right Angles, or 180 Degrees.

3. Now the Angle C B G, being an obtuse Angle, it is impossible that a Line can be drawn from the *Fulcrum* C to the Line of Direction B G, and to be perpendicular to it too.

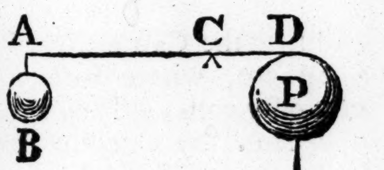
But to supply this Defect, you must continue on the Line of Direction G B, through the Point of Application B, upwards towards H; and then if a Perpendicular be let fall from the *Fulcrum* C, to the continued Line of Direction B H, it will cut the Line B H in H, then C K.

4. If the Distance of the Power G from the Power F be equal the Distance of the Power E from the Power F, then will the Perpendicular C H be equal to the Perpendicular C E, and therefore the Power apply'd at G, whose obtuse Angle C B G exceeds the Right Angle C B F, as much as the acute Angle C B E is less than the Right Angle C B F is equal in Force to the Power E, and both less in Force than the Power E, which was to be demonstrated.

Hence

Hence it is evident, that if the Power G was to thrust or press at H on B, its Force would be the very same, as when pulling at G, and that when Workmen apply their Strength to raise up heavy Weights, they should always endeavour to apply the same as near to a Right Angle with a Lever, as they possibly can.

Question. Has not a Power as P, being hung close to the *Lever* A D, a greater Force than when hung on the same Point D at the End of a long Cord or Line, as the Weight E?



Answer. No? If the Bodies P and E are equal, the Body E will have the same Force as the Body P, and if the Gravity or Weight of the Cord be considered and added to it, it will have a greater Force than the Body P, for were the Weight E to be sustain'd by the End of the Cord at D, both their Weights must be sustain'd at the same Time.

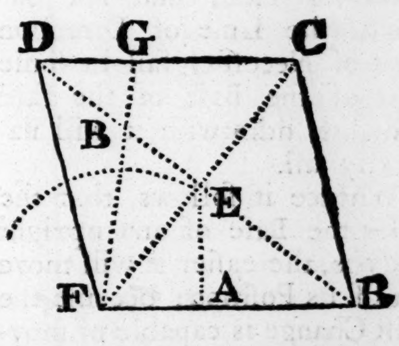
As to the natural Descent of heavy Bodies and of their Line of Direction, in which they endeavour to descend,

A heavy Body naturally descends to the lowest Place it can go, provided that its Descent is not oppos'd by any other heavy ody.

And as all the Parts of *Homogeneous* Bodies have an equal Pressure about their Centres of Gravity, therefore the chief Endeavour of Bodies to descend, is made by the Descent of their Centres of Gravity.

For if the Centre of Gravity of a Body do not descend, but remain fix'd, the whole Body will remain fix'd also; because it is to the Centre of Gravity, that all the Parts of the Body have a close Adherence.

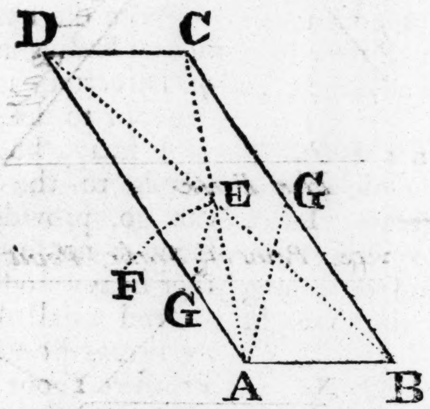
Hence it is plain, that the inclin'd Body C D B A cannot fall towards F, which it inclines to, because its Centre of Gra-



vity E, must be obliged to ascend and pass through the Arch

E P, which it cannot do, the Part or Quantity G C A B ſtanding over the Baſe, wherein the Centre of Gravity is, being greater than the inclining Part G D A.

Therefore it is evident, that no ſuch Body can deſcend, when the Line of Direction or Centre of Gravity doth not exceed the Extremes of the Baſe B A.



And on the Contrary, when the Centre of Gravity of an inclin'd Body, as E exceeds the Limits of the utmoſt Perpendicular, as G A, whereby the Part ſtanding over the Baſe G B A is leſſer than the inclining Part G A C D: Then ſuch Bodies will fall, for the Centre of Gravity E, having A for its Centre, will freely deſcend in the Arch E F.

Now 'tis very plain, that to have a Body remain ſtedfaſt upon its Baſe, and not inclin'd, the Line of Direction muſt of Neceſſity fall in ſome Part of the Baſe of the ſaid Body, or otherwiſe it will naturally fall.

Whence it follows, that the leſſer the Baſe of any upright Body is, the eaſier it will move out of its Poſition; becauſe the leaſt Change is capable of moving the Line of Direction out of its Baſe.

This is the Cauſe why a Ball or Sphere, whoſe Baſe is a Point only, rolls eaſily on a plain Superficies, by a gentle Force.

The Law of Mechanicks is obſerv'd by every Animal, in their riſing and ſtanding, to prevent their falling; as for Example in human Bodies, when we are to riſe from a Seat we naturally bend our Bodies forward, ſo as to cauſe the Line of Direction of our Bodies to paſs through our Feet, upon which we bear our ſelves when we begin to aſcend.

Now from the preceeding it follows, that the wider the Baſe of any Body is, the eaſier it will ſupport it ſelf, becauſe then the Line of Direction cannot go out of the Baſe without greater Force.

This being well underſtood will be of very great Service to Painters, Carvers and Statuaries, in giving their Figures ſuch

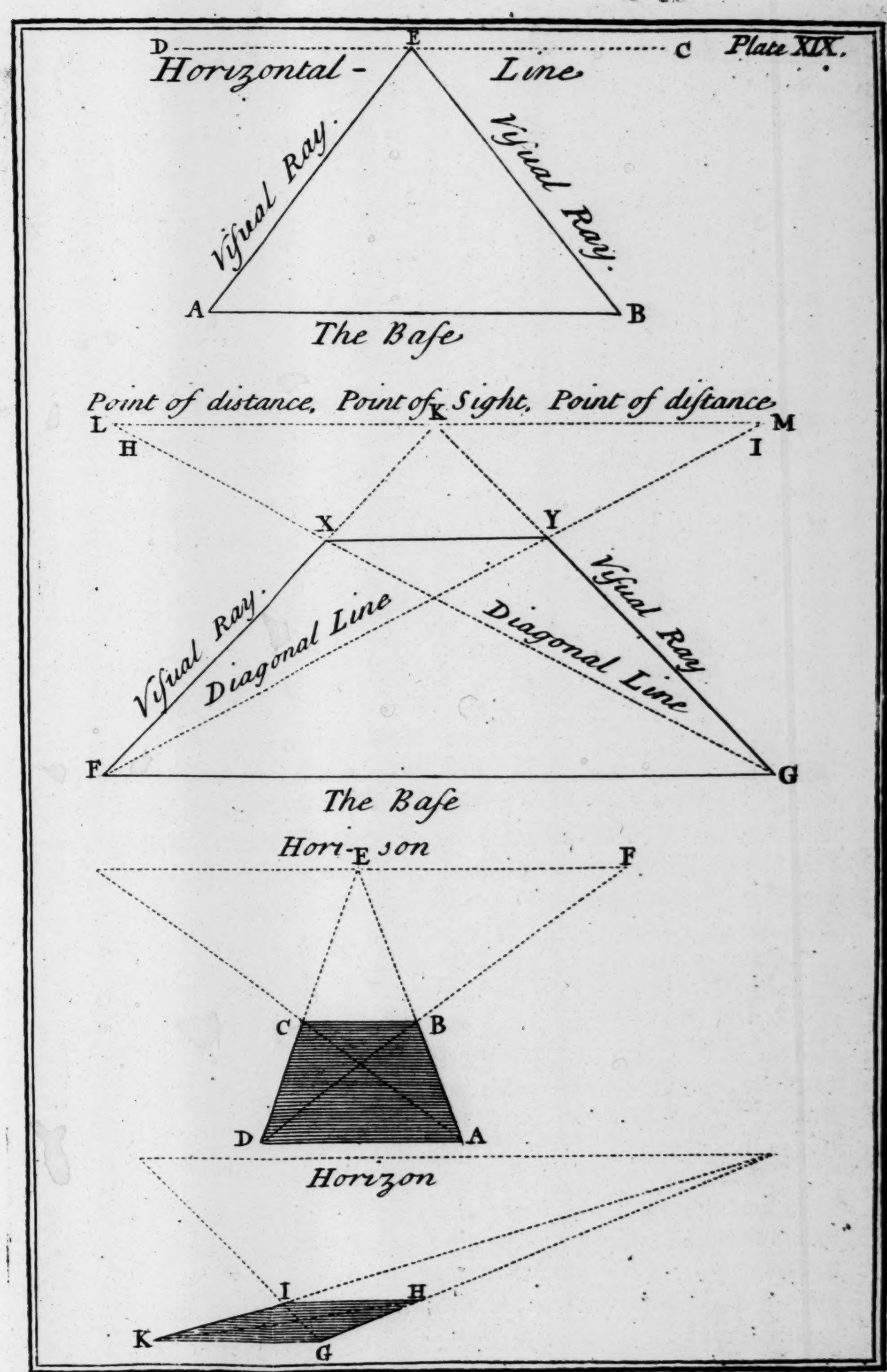


Plate XIX.
D
E
C
Horizontal - Line
Visual Ray.
Visual Ray.
A
B
The Base
Point of distance, Point of Sight, Point of distance
L
K
M
H
I
X
Y
Visual Ray.
Diagonal Line
Diagonal Line
Visual Ray
F
G
The Base
Hori-E son
F
C
B
D
A
Horizon
I
H
K
G

ſuch Poſtures as are agreeable to Nature; as alſo to Maſons, Bricklayers, &c. in proportioning the Thickneſs of Walls, according to their ſeveral Heights requir'd.

It is worthy Notice, that all the Powers or Bodies produc'd are ſuch as equipoiſe each other, or are equal in Power to each other, according to their ſeveral Ratio's. And therefore,

Take Notice, that when a Power can ſuſtain a Weight, by the Means of any Ballance, Lever, &c. a Power greater, as little as can be imagin'd, will over-poiſe, or cauſe the ſaid Weight to riſe.

Likewiſe take Notice, that the Weight of the Levers, Pullies, &c. and their Friction is not conſider'd, a Lever being conſider'd as a Right Line, and a Pully as moving on a real Point.

N.B. *The Copy of the following Articles in* POINT *and* POLYGON, *being miſplac'd, and not coming Time enough to be put into the laſt Sheet, we inſert it in this.*

POINT *of Sight*
POINT *of the Eye*
Principal POINT
Perſpective POINT
[in *Perſpective*] is a Point in the Axis of the Eye, or in the Central Ray, where the ſame is interſected by the Horizon.

Thus the Point E is the Point of Sight in the Horizon C D, wherein all the viſual Rays meet. It is call'd the *Point of the Eye*, or *ocular Point*, becauſe directly oppos'd to the Eye of the Perſon, who is to view the Piece. See *Plate* Fig. 1.

POINT or POINTS of *Diſtance* [in *Perſpective*] is a Point or Points (for there are ſometimes two of them) plac'd at equal Diſtance from the Point of Sight. They are thus denominated by Reaſon that the Spectator ought to be ſo far remov'd from the Figure or Painting, and the Terreſtial Line, as theſe Points are from the Point of the Eye, and are always to be in the Horizontal Line.

Thus H I being the Horizon and K the Point of Sight, L and M are Points of Diſtance, ſerving to give all the Shortenings. See the *Plate* Fig. 2.

Thus *ex. gr.* If from the Extremes of the Line F G you draw two Lines to the Point K, and from the ſame Points draw two Lines to the Points of Diſtance M and L, where theſe two Lines G L and F M cut the Lines F K and G K in the Point, X and Y will be the Line of Depth, and the Shortening of the Square, whereof F G is the Side and Baſe. The Lines drawn to the Point of Sight, are all viſual Rays, and thoſe drawn to the Points of Diſtance, are all Diagonals. See *Plate* Fig. 2.

Accidental POINTS
Contingent POINTS
[in *Perſpective*] are certain Points, wherein ſuch Objects as may be thrown negligently and without Order under the Plan, do

tend to terminate. For this Reaſon they are not drawn to the Point of Sight, nor the Points of Diſtance, but meet accidentally or at Random in the Horizon.

POINT of the FRONT [in *Perſpective*] is when we have the Object directly before us; and not more on one Side than the other, in which Caſe it only ſhews the Foreſide, and if it be below the Horizon, a little of the Top too, but nothing of the Sides, unleſs the Object be Polygonous.

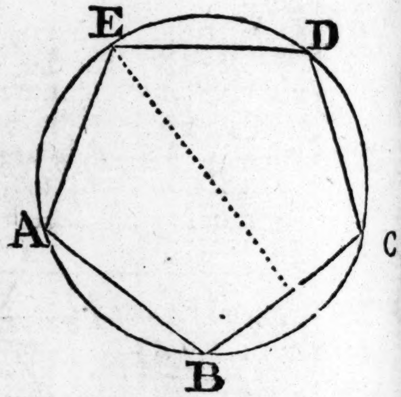
Thus the Plan A B C D, is all Front, and if it were rais'd, we ſhould not ſee any Thing of the Sides A B or C D, but only the Front A D: The Reaſon is, that the Point of View E, being directly oppoſite thereto, cauſes a Diminution on each Side; which however is only to be underſtood where an Elevation is the Object; for if it be a Plan, it ſhews the whole, as A B C D. See the *Plate* Fig. 3.

Side POINT. The Point of OBLIQUE VIEW, or of the SIDE, is when we ſee the Object aſide of us, and only as it were aſlant or with the Corner of the Eye; the Eye however being all the while oppoſite to the Point of Sight; in which Caſe we view the Object laterally, and it preſents us two Faces or Sides.

For Inſtance, if the Point of Sight be in F, the Object G H I K, will appear athwart, and ſhew two Faces G K, and G H, in which Caſe it will be a Side Point. The Practice is the ſame in the Side Point, as in the Front Points; a Point of Sight, Points of Diſtance, &c. being laid down in the one as well as the other. See *Plate* Figure 4.

To deſcribe any Regular POLYGON, *ſuppoſe the* PENTAGON A B C D E.

Divide the Circumference of the Circle, *viz.* 360 Degrees, by (5) the Number of Sides, contain'd in the Polygon, and the Quotient will be the Number of Degrees contain'd in the Arch of one Side.



So 360 being divided by 5, the Quotient will be 72.

Then taking 72 Degrees from your Line of Chords, ſet that Diſtance from A to B, from B to C; from C to D; from D to E, and from E to A, and then join A B, B C, C D, D E and E A, the Polygon required.

Regular POLYGONS are all ſuch Figures as have more than four Sides; all the Sides and Angles of them being equal. *Polygons*, are denominated from the Number of their Sides and Angles.

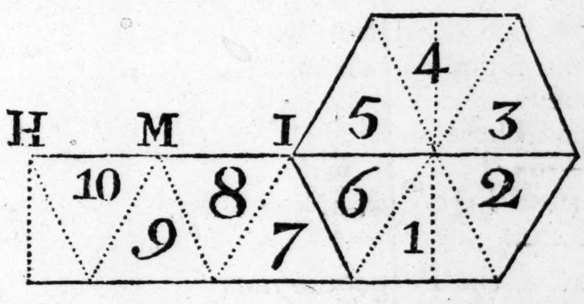
If

If the Figure consists of		Equal Sides and Angles, it is call'd a Regular	
	5		Pentagon.
	6		Hexagon.
	7		Heptagon.
	8		Octagon.
	9		Enneagon.
	10		Decagon.
	11		Endecagon.
	12		Dodecagon.

Polygon. *Every Polygon is equal to a Parallelogram, whose Length is equal to half the Perimeter or Circumference thereof, and Breadth to a Perpendicular drawn from the Centre to the middle of any Side of the same.*

Let the Hexagon I D H L O P, be the given Polygon, and N a Perpendicular, drawn om the Centre N, to the middle of the Side D H.

2. Draw Right Lines from the Centre N, to the Angles I D H L O P: also continue E D to A, making E A equal to half the Perimeter of the *Polygon*; that is, make D C equal to H L; C B equal to L O; and H A, equal to E H, then compleat the Parallelogram A E K N, and make I M and M K equal to I N.



Now I say, that the Parallegram A E K N, whose Length E is equal to half the Cirmference of the Polygon, and eadth to the Perpendicular N, is equal to the Polygon H L O P I. For as the Trigles 1, 2, 3, 4, 5, 6, are all ual to one another; so also the Triangles, 7, 8, 9 and equal thereto also, because y are all of equal Bases and ween the same Parallels A H K L.

Now seeing that the Triangles D N E, and D I N are already compris'd within the Parallelogram A E K N, it only remains to prove that the Triangles 7. 8, 9, 10, and A B K, are equal to the remaining Triangles of the Polygon E N H, 2, 3, 4 and 5.

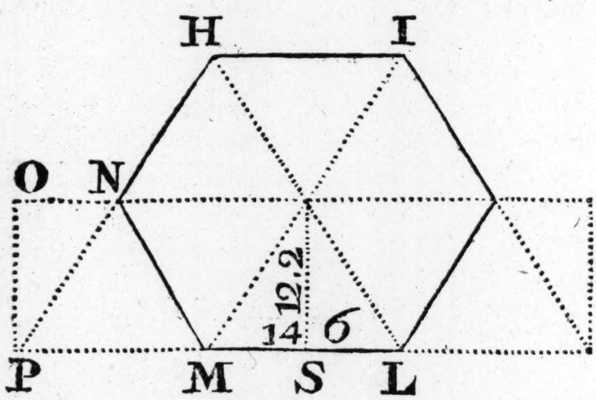
It has been already prov'd, that the several Triangles 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 are equal to one another; therefore the Triangle 7, may be said to be equal to the Triangle 5; the Triangle 8, to the Triangle 4, the

the Triangle 9, to the Triangle 3, the Triangle 10, to the Triangle 2; and lastly, the Triangle A B K to the Triangle E N H; therefore is the Parallelogram A E K N equal to the Polygon I D H L O P. Q. E. D.

Corollary.

Hence appears the Reason of the general Rule for the Mensuration of Polygons, to multiply half the Circumference by a Perpendicular, let fall from the Centre upon one of the Sides.

To find the Area or Superficial Content of any Regular Polygon.



14.6
3
43.8 half Sum of the Sides.
12.64 the Perpendicular.
43.8 half Sum.
10112
3792
5956
553.632 Area.

14.6
6
87.6
63.2
1752
2628
5256
553.632 Area.

Let H I K L M be a Regular Hexagon, each Side thereof being 14.6, the Sum of all the Sides is 87.6 the half Sum is 43.8, which being multiply'd by the Perpendicular S, 12, 64 the Product is 553.63. : or if 87.6, the whole Sum of the Sides be multiply'd by half the Perpendicular 6.32 the Product will be 553.63 the same as before, which is the Area of the given Hexagon.

By Scale and Compasses.

Extend the Compasses from to 12.2, that Extent will reach om 43.8, the same Way to 53.63: or extend the Compasses from 2 to 12. That Extent will reach from 87.6, to 553.63.

Demonstration.

Every Regular Polygon, is equal to the Parallelogram or long Square, whose Length is equal to half the Sum of the Sides and Breadth equal to the Perpendicular of the Polygon, as appears by the preceeding Figure; for the Hexagon H I K L M N is made up of six equilateral Triangles, that is five whole ones and two halves; therefore the Parallelogram is equal to the Hexagon.

A Table for the more readily finding the Area of a Polygon.

Number of Sides.	Names.	Multipliers.
3	Trigon	.433013
4	Tetragon	1.000000
5	Pentagon	1.720477
6	Hexagon	2.598076
7	Heptagon	3.633959
8	Octagon	4.828427
9	Enneagon	6.181827
10	Decagon	7.694209
11	Endecagon	8.514250
12	Dodecagon	9.320125

Multiply the Square of the Side by the Tabular Number, and the Product will be the Area of the Polygon.

PRIME *Nmmbers* [in *Arithmetick*] are those made only by Addition or the Collection of Unites, and not by Multiplication, so an Unite only can measure it, as 2, 3, 4, 5, *&c.* and is by some call'd a *simple*, and by others, an *uncompound Number*.

PRIME *Figure* [in *Geometry*] is that which cannot be divided into any other Figures more Simple than it self; as a Triangle into Planes, a Pyramid in Solids; for all Planes are made of the first, and all Bodies or Solids are compounded of the Second.

PRIMING [in *Painting*] is the laying on of the first Colour.

PRINCIPAL *Point*, [in *Perspective*] is a Point in the Perspective Plane, upon which a Line drawn from the Eye, perpendicular to the vertical Plane; or it is that Point of a Picture, wherein a Ray, drawn perpendicular to it, cuts it.

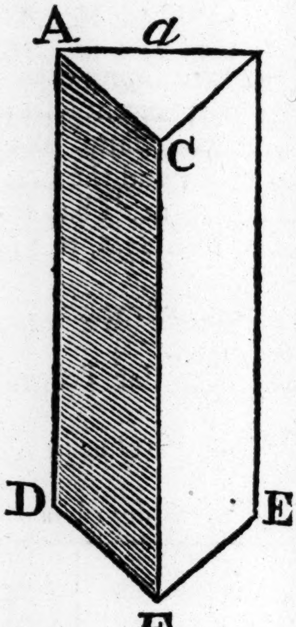
PRINCIPAL *Ray* [in *Perspective*] is that which passes perpendicularly from the Spectator's Eye, to the Perspective or vertical Plane.

PRISM-

PRISM is a Solid contain'd under ſeveral Planes, and having its Baſes alike equal and parallel, the Solid Content of a Priſm (whether Triangular or Multangular) is found by multiplying the Area of the Baſe into the Length or Height, and the Product will be the ſolid Content.

Let A B C D E F be a triangular Priſm, each Side of the Baſe being 15. 6 Inches; the Perpendicular of it C *a*, is 13. 51 Inches, and the Length of the Solid, 19. 5.

Multiply the Perpendicular of the Triangle, 13. 15. by half the Sum 7. 8, and the Product will be 105. 378, the Area of the Baſe; which multiply by the Length 19. 5, and the Product will be 2054. 871,



which divide by 144, and the Quotient is 14 . 27 Feet *fere*, the Solid Content.

```
     13.51
       7.8
     10808
     9457
    105 378
      19.5
    526890
   948402
  105378
  2054.8710
```

```
144) 2054.87 (14.27
     144
      614
      576
       388
       288
       1007
       1008
```

By Scale and Compaſſes.

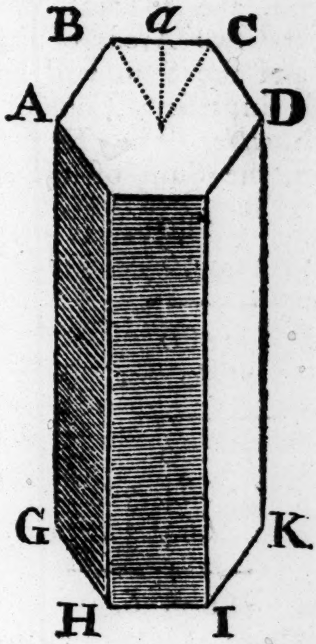
Firſt, Find a mean Proportional between the Perpendicular and half Side, by dividing the Space upon the Line (as taught in the Parallelopipedon) between 13.51 and 7.8, into 2 equal Parts; ſo ſhall you find the middle Point between them to be at 10.26, which is the mean Proportional ſought; by this Means the Triangular Solid, is brought to a ſquare, each Side being 10.26 Inches.

Then extend the Compaſſes from 12 to 10.26; that Extent turn'd twice downwards from 19.5 Feet the Length, will at laſt fall upon 14.27. which is 14 Feet and a little above a quarter.

Hexan-

exangular PRISM. Let
CDEFGHIK, re-
ent a Prism, whose Base is
exagon, each Side of which
Inches, and the Perpendi-
r from the Centre of the
to the middle of one of
Sides (ab) is 13.84 In-
, and the Length of the
n is 15 Feet; the Solid
ent is requir'd.

ultiply half the Sum of
Sides 48 by 13.84, and the
duct will be 664.32, the
of the Hexagonal Base,
h multiply by 15 Feet, the
gth of the Product will be
.8, which divide by 144,
the Quotient will be 69.2
, the Solid Content re-
'd.




```
   13.84
      48
  ------
  11072
  5536
  ------
  664.32   Area of the Base.
      15
  ------
  332160
  66432
  ------
  9964.80

144) 996480 (69.2
     864
     ----
     1324
     1296
     ----
      288
      288
      ---
      000
```

y Scale and Compasses.

irst, Find a mean Propor-
l between the Perpendicu-
nd half the Sum of the
, that is, divide the Space
een 13.84 and 48, and the
dle Point will be 25.77.
hen extend the Compasses
from 12 to 25.77; and that
Extent will reach (being twice
turn'd over) from 15 Feet the
Length, to 69.2 Feet the Con-
tent.

To find the Superficial Con-
tent of any of these Solids, you
must take the Girt of the
Piece, and multiply by the
Length

Length, and to that Product add the two Areas of the Bases, and the Sum will be the whole Superficial Content.

Example. The Hexagonal Prism, the Sum of the Sides

```
  180
   96
 ----
 1080
1620
-----
17280
  664 32
  664 32
--------
18608 64
```

being 96, the Product will 17280 square Inches, to wh add twice 664.32 the Area the two Bases; and the S is 18608.64, the Area of whole which is 129.22 Feet.

```
144) 18608·64 (129.22
     ----
      420
      1328
      ----
       326
        384
        ---
         96
```

The Superficial Content of the whole Solid is 129.22.

By Scale and Compasses.

Extend the Compasses from 144 to 180, and that Extent will reach from 96 to 120 Feet; then to find the Area of the Base, extend the Compasses from 144 to 13.84 and that Extent will reach from 48 to 4.6 Feet; add 120 Feet, and twice 4.6 Feet, and it will make 129.22 Feet, the Superficial Content, as before.

The Demonstration of these Prisms will be the same as in that of the Cube; for as in that, so in those, the Area of the Base is multiply'd into the Length to find the Content, and the same Reason is given for the one, as for the other.

1. PRISM [in *Opticks*] is a Glass bounded with two equal and parallel triangular Ends, and three plane and well polish'd Sides, which meet in three parallel Lines, running from the three Angles of one End to those of the other, and is us'd in Opticks to make many noble and curious Experiments about Light and Colours; for the Rays of the Sun falling upon it at a certain Angle, do transmit thro' it a Spectrum or Appearance, colour'd like the Iris or Rainbow in the Heavens.

2. The Surface of a Right Prism, is equal to a Parallelogram of the same Height, having for its Base a Right Line equal to the Periphery of the Prism.

3. All Prisms are to one another in a Ratio, compounded of their Bases and Heights.

4. All like Prisms are to one another in the Triplicate Ratio of their answerable Sides.

5. A Prism is the Triple of a Pyramid of the same Base and Height.

RISMOID [in *Geometry*] solid Figure, bounded by ral Planes, whose Bases are ht angled Parallelograms, llel and alike situated.

ROBLEM [in *Geometry*] Proposition wherein some ration or Construction is ired, or it is a Proposition ch refers to Practice, or ch propotes someth ng to be ; as to divide a Line, to struct an Angle, to draw a le into three Points, not in ight Line, *&c.*

olfius says a *Problem* con- of three Parts.

The Proposition which resses what is to be done.

The Resolution or Solu- wherein the several Steps reby the Thing required is e effected, are orderly re- sed.

The Demonstration where- shewn, that by doing the ral Things prescrib'd in the olution, the Thing requir'd tain'd.

ccordingly the general Te- of all *Problems* is this, the ngs prescrib'd in the Reso- on being done, the Thing ired is done.

o PRODUCE [in *Geome-* signifies to continue a ht Line, or draw it out er, till it have any assigned gth.

RODUCT [in *Arithme-*] is the Number arising , or produc'd by the Mul- cation of two or more nbers into one another. s if 5 be multiply'd by 4, Product is 20.

RODUCT [in *Geometry*] is the Quantity arising by the Multiplication of two or more Lines one into another; in Lines it is always call'd the *Rectangle.*

PROFILE [in *Architecture*] is the Figure or Draught of a Building or the like, wherein are express'd the several Heights, Breadths and Thicknesses, such as they would appear if the Building were cut down perpendicularly from the Roof to the Foundation, whence the *Profile* is also call'd the *Section*, and by *Vitruvius*, *Sciagraphy.*

PROFILE is also us'd for the Contour or Out-line of any Member of a Building, as that of the Base, a Cornice or the like.

Hence *Profileing* is sometimes us'd for designing or describing the Member with Rule, Compass, *&c.*

PROFILE is us'd for a Prospect of any Place, City or Piece of Architecture, view'd Sideways, and express'd according to the Rules of Perspective.

PROFILE is sometimes us'd for a Design or Description; in Opposition to a Plan or *Ichnography*. In which Sense Profile signifies the same with what we popularly call a Prospect, as above.

PROFILE [in *Sculpture*, *Painting*, *&c.*] is us'd of a Head, Portrait, *&c.* which are said to be in Profile, when they are represented Sideways, or with a Side view: As when in a Portrait, there is but one Side of the Face, one Eye; one

Cheek, &c. shown, and nothing of the other.

PROJECTILES [in *Mechanicks*] are heavy Bodies put into a violent Motion, by any great external Force impress'd thereon; and then cast off or let go from the Place where they received their Quantity of Motion, and are afterwards moved at a Distance from it, as a Stone thrown out of a String, an Arrow from a Bow, a Bullet from a Gun, &c.

PROJECTION [in *Mechanicks*] is the Action of giving a Projectile its Motion.

Monstrous PROJECTION, See ANAMORPHOSIS.

PROJECTURE [in *Architecture*] signifies the Out-jetting, Prominency or Embossment, which the Mouldings, and other Members have, beyond the naked Wall, Column, &c. and is always in Proportion to its Height.

The Word is also apply'd to Galleries, Balconies, &c. which jet out beyond the Face of the Wall.

Vitruvius gives it as a general Rule, that all *Projecting* Members in Building, have their *Projectures* equal to their Heights. But this is not to be understood of particular Members or Mouldings, as Dentils, Corona's, the *Fasciæ* of Architraves, the *Abacus* of the *Tuscan* and *Dorick* Capital, &c. but only of the Projectures of intire Cornices.

Some modern Architects are of Opinion that the great Point in Building consists in knowing how to vary the Proportions of *Projectures* agreeable to t Circumstances of the Buildi

Thus they lay the near and remoteness making a d ferene in the View requires d ferent *Projectures*, but it's pl that the Antients had no fu Intention.

M. *Perrault* observes t the Projecture of the Base a Cornice is greater in the A tique than in the modern Bui ings by $\frac{1}{3}$: which seems to f low in good Measure from Antients Proportioning the *P jecture* to the Height of t Pedestal; whereas the Mode make the *Projecture* the same all the Orders, tho' the Height the Pedestal be very differe

PROPORTION [in *Ari metick*] is the identity or sim tude of two ratio's.

Arithmetical Proportion, the equality of two or more rithmetical ratio's, or the eq lity of difference between th several quantities.

Geometrical PROPORTIO is the equality of two geo trical ratio's or comparison two couples of Quantities.

PROSTYLE [*in Archi ture*] a range of columns in front of a Temple.

PROTHYRUM [in *Ar tecture*] a Porch at the o ward door of a House.

PROTHYRIS is also used *Vignola* for a particular for a Key of an Arch, an insta of which is found in his *Io* Order; which consists of a of water leaves, between Riglets and two Fillets, crow with a *Dorick Cymatium*; figure being much like tha a *Modillion*.

PR

PROTHYRIS [in the an-
nt *Architecture*] is also
netimes used for a Quoin or
ner of a Wall; and also some-
es for a cross Beam and over-
art Rafter.

PSEUDO DIPTERE [in
ancient *Architecture*] a
mple, having eight columns
ront, and a single row of co-
ns all around.

PUDLAYS, pieces of stuff
do the office of levers or
ndspikes.

PULVINATA a Freeze, a
lling or bulging out in man-
of a Pillow.

PULLEY [in *Mechanicks*]
one of the five mechanical
vers, consisting of a little
eel or rundle, having a chan-
round it, and turning on
Axis, serving (by means of
pe which slides in the chan-
) for the raising of Weights.

n several cases where the
is in *Peritrochio* cannot
veniently be apply'd, Pul-
must be made use of in
ng weights.

A Machine formd by com-
ng several of them, lies in a
e compass, and is easily car-
about, if the Weight be
to the Pulley, so that it
be drawn up along with
Each end of the drawing
unning rope sustains half the
ght; therefore when one
is fixt either to a Hook or
other Weight the moving
, or power apply'd to the
r end of it, if it be equal to
the weight, will keep the
ght in equilibrio.

everal sheaves may be join'd
ny manner, and the weight
be fixt to them; then if one end of the Rope be fixt, and the Rope goes round all those sheaves, and as many other fixed ones as is necessary, a great weight may be raised by a small power.

In that case the greater number of sheaves fix'd in a moveable pulley, or of moveable wheels (for the fixed ones do not change the action of the power) so much may the power be less which sustains the weight; and a power which is to the weight, as the number one, to twice the number of the Sheaves.

The Doctrine of the Pulley.

If a power P, sustains a weight Q, by means of a single pulley AB, in such manner as that the Line of Direction of each is a tangent to the periphery of the rundle, the weight and the power are equal. See *Plate* Fig. 1.

Hence, a single *Pulley*, if the lines of direction of the power and weight be tangents to the periphery, neither assists nor impedes the power.

The use of the *Pulley* therefore is, when the vertical direction of a power is to be changed into an horizontal one; or an ascending one into a descending one, and on the contrary.

This is found a good provision for the safety of the workmen employ'd in drawing with the *pulley*: For suppose a large weight EFg, be required to be rais'd to a great height, by workmen pulling the rope AB: if

if now the rope ſhould chance to break, the workmens heads underneath would be in immediate danger; but if by means of the pulley B, the vertical direction AB, be changed into a horizontal one BC, there is no danger from the breaking of a Rope. This change of direction by means of a pulley, has this advantage further, that if any power can exert more force in one direction than another, we may be here able to employ it in the greateſt force. See *Plate* Fig. 2.

Thus for Example, a horſe cannot draw in a vertical direction; but draws with all its advantage in a horizontal one; therefore by changing the vertical draught into a horizontal one, a horſe becomes qualified to raiſe a weight.

2. If a power apply'd in G, according to the line of direction BE, which is a tangent to the pulley in E, and parallel to the rope AD, ſuſtain the weight F, ſuſpended from the center of the pulley G, the power is ſubduple of the weight. See *Plate* Fig. 3.

But the grand uſe of the pulley, is where ſeveral of them are combin'd; thus forming what *Vitrivus* and others after him call *Polyſpaſta*; the advantages whereof are, that the machine takes up but little room, is eaſily removed, and raiſes a very great weight with a very moderate force.

The Effect of *Polyſpaſta* is founded upon the following Theorem.

3. If a power apply'd in B, ſuſtain (by means of a *polyſpa- ſton)* a weight F, ſo that all th ropes AB, HI, GE, EL, CD drawn by the weight F, ar parallel to each other: Th power will be to the weigh as unity to the number of rop HI, GF, FL, CD, draw by the weight B, and therefor as unity is to the number pulleys higher and lower take together. See *Plate* 2. Fig.

Hence the number of pulley and the power being given, is eaſy to find the weight th will be ſuſtained thereby: the number of pulleys an weight to be ſuſtained bei given, the power is found; the weight and power being g ven, the number of pulleys t *polyſpaſton* is to conſiſt of found.

4. If a power move a weig by means of ſeveral pulleys, t ſpace paſſed over by the pow will be to the ſpace paſſed ov by the weight, as the weight to the power.

Hence, the ſmaller the for that ſuſtains the weight, (means of the pulley) is, t ſlower is the weight raiſed, that what is ſav'd in force, ſpent in time. Others defin

A Pulley to be a wheel wood, braſs, iron, &c. that moveable about a ſmall pin axis, call'd a center-pin, to whi in theory we allow no thic neſs, and therefore is conſide ed as a line only.

This pin with the wheel fix'd in a box of iron or wo &c. wherein it is work'd means of a rope plac'd in t grove of its circumference, in the figure 5.

Th

here are ſeveral kinds of
eys; as the ſingle pulley,
'd by workmen a *Snatch-*
k) and the double triple,
pulley, call'd a pair of
ks, &c.

order to conceive how
y weights may be raiſed by
power of the pulley, obſerve
to equipoiſe the weight by
ſingle pulley BAC.

the Diameter of the pul-
BC, be conſidered as a *lever*
e firſt kind, wherein A is
Fulcrum, it is evident that
nd C, the extreams of the
eter BC, are at equal di-
es from the *fulcrum* A,
refore to equipoiſe the body
e muſt be a weight at E e-
to D.

r, as AC the diſtance of
power,

to BA, the diſtance of the
ht;

is the weight D, to the
er E, or *e contra*.

is the power E, to the
ht D.

ence 'tis plain, that an up-
pulley as B A C is a lever
e firſt kind (ſee LEVER)
ts *fulcrum* is at equal diſ-
s from the points of diſ-
of the power apply'd and
t to be raiſed, therefore
power apply'd cannot equi-
any greater weight than
which is equal to itſelf.

See *Plate Fig.* 4.

that it may ſeem, that a
y is of no more uſe, than
by its turning motion it
rves the rope from fret-
and from a very great
n, which would require
dditional ſtrength, when drawn over an immoveable body, as a beam, &c. that would not turn as a pulley does.

But in anſwer to this, it is indeed ſo in upper Pulleys, but in them only: for tis otherwiſe in under Pulleys, as the Pulley NKL. Fig. 5.

The difference lies in this; as you may obſerve, the weight M hangs in the middle at R, and the Rope FN is always lifting at N, and as the other Rope LR, is fix'd at R, therefore conſidering the Diameter of the Pulley NLK as a *Lever* of the ſecond kind, the point N, will be the Point where the Power is apply'd, and the Point L will be the *Fulcrum*. Then I ſay,

As KL, the diſtance of the weight from the *Fulcrum*.

Is to NL, thediſtance of the power from the *Fulcrum*;

So is the power apply'd at N, to the weight that it will equipoiſe at K.

Hence it is plain, that as the diſtance of the power, is equal to twice the diſtance of the weight, therefore the power apply'd will equipoiſe double its weight; wherefore it is always to be underſtood, that by every ſuch Pulley the Force is doubled. See *Plate* Fig. 5.

Now from theſe two Examples, ariſes the following THEOREM.

When a Power (as X) ſuſtains, or draws a weight, by means of ſeveral Pullies, (as BC, IOK, LM; EOF,) each Pulley under which the Rope goes, as EOF, or LM, is equivalent to a *Lever* of the ſecond

kind, as before prov'd, and therefore needs no Demonstration.

It is evident, that every lower *Pulley* is a Lever of the second kind; and as the weight is always in the middle between the power and *Fulcrum*, 'tis very easy to judge or determine, what number of under-Pullies are necessary to equipoise any weight with a given Power.

As for *Example*.

Suppose a Body of 500 Pounds weight, is to be equipois'd by a Power of 25 Pounds weight; how many under Pullies are required for that Purpose?

This Question is easily answered; for as the Power is equal to double the weight, therefore 25 Pound apply'd to one Pulley, will equipoise 50 Pound.

Now if 500, the weight given, be divided by 50, the equipoise of one under Pulley, the Quotient will be 10, the number of under Pulleys required.

But this is worthy Notice; That as much as the Power gains, in Force by means of many under Pullies, so much it loses in Space and Time. See *Plate*, Fig. 6.

Suppose a Power apply'd at A, which draws the Rope downwards to R, to draw up or raise the four Weights B C D E, of the Box PQ, on which they are fix'd.

I say, that in this and all such Cases, the Power A must descend, or run through a great Space, while the Weights rise through a small Space; that is, the Power A must move e[illegible] Feet to raise the Bodies [illegible] D E one foot, because [illegible] Parts of the Rope are ap[illegible] to the lower Pullies; there[illegible] it is to be observed in th[illegible] of Pullies as in the use of [illegible] vers.

That the Space which [illegible] weight runs through,

Is to the Space which [illegible] Power runs through;

As the Power,

Is to the Weight.

Or, As the Number one,

Is to twice the Numbe[illegible] lower Pullies, *viz.* 8;

So is the Power apply'd, [illegible] the weight that it will e[illegible] poise.

Thus it appears, tha[illegible] more Velocity the Power [illegible] the greater is its Force pr[illegible] tionably.

PUMP [in *Hydraulicks*] a Machine formed of a Syr[illegible] for raising of Water.

PUMPS are distinguishe[illegible] to several Kinds, with re[illegible] to the several manners of [illegible] acting. As,

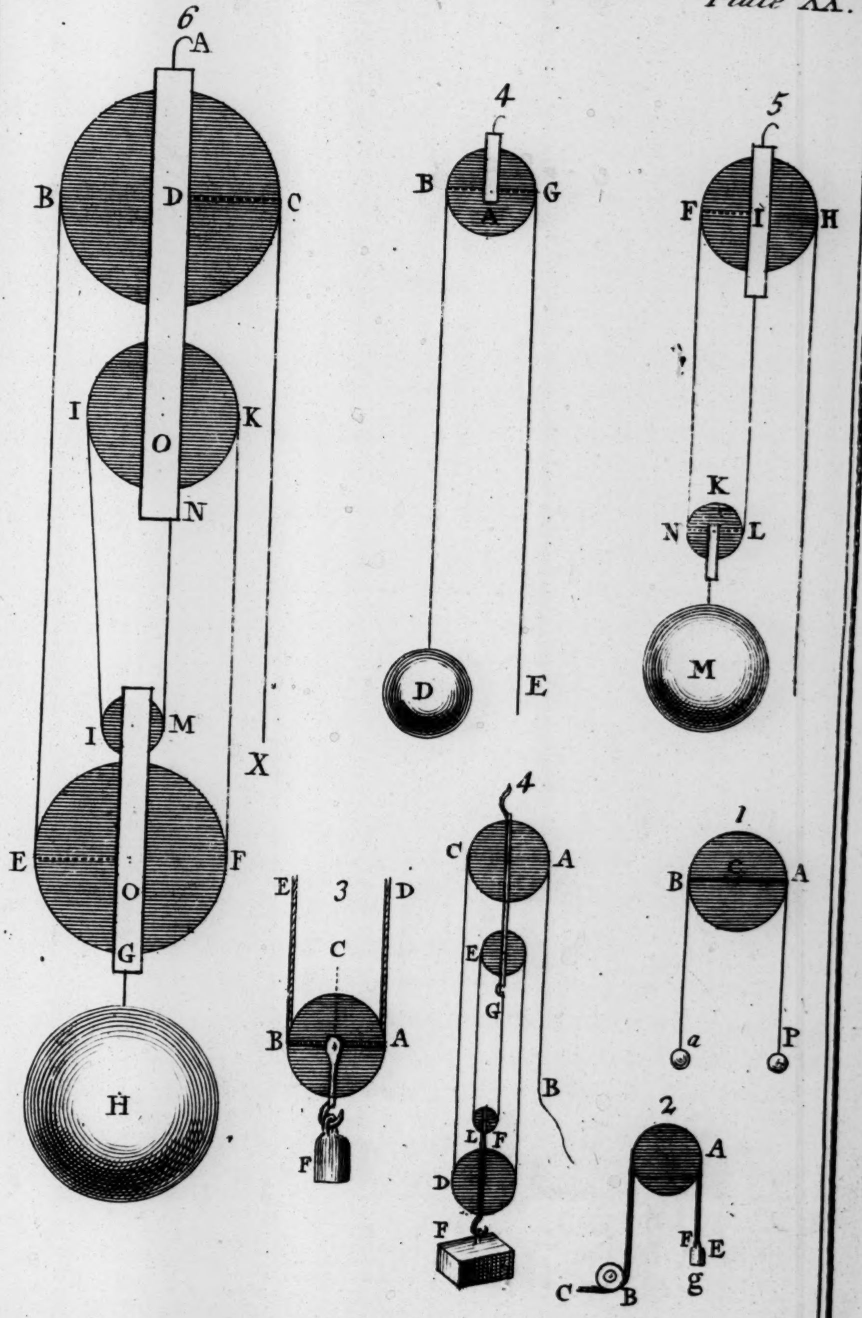
1. The *Common Pump*, so[illegible] times called the *Sucking P*[illegible] which acts by the Pressu[illegible] the Air, and whereby Wat[illegible] rais'd out of lower into a hi[illegible] Place not exceeding 32 Fe[illegible]

The *Forcing Pump*, w[illegible] acts by mere Impulse and [illegible] trusion, and raises Water t[illegible] ny Height at Pleasure; [illegible] also another.

Called *Ctesebes*'s *Pump*, w[illegible] was the first and is the fine[illegible] them all, which acts bot[illegible] Suction and Expulsion.

E

Plate XX.



6
A
B
D
C
I
O
K
N
I
M
X
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F
G
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4
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D
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B
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E
g
C
B

PUNCHEON is a common [na]me for all the Iron Instru[me]nts used by Stone-Cutters, [Sc]ulptors, Locksmiths, &c. for [cut]ting or piercing their several [Le]tters.

PUNCHION } [in *Carpen-*
PUNCHIN } *try*] A piece [of] Timber placed upright be[tw]een two Posts, whose bearing [is] too great, serving together [wit]h them to sustain some great [W]eight.

The PUNCHEON is usually [low]er and slighter than the [Pos]ts, and is join'd by a Brace [or t]he like of Iron.

Puncheon is also a piece of [Ti]mber raised upright, under [the] Ridge of a Building, wherein [the] little Forces, &c. are joint[ed.] *Vitruvius* calls the Pun[che]on *Columen. Puncheon* is al[so u]sed for the Arbour or prin[cipa]l Part of a Machine, on [whi]ch it turns vertically as that [of a] Crane, &c.

[P]URLINS [in *Building*] [are thos]e pieces of Timber that lie [acr]oss the Rafters on the inside, [to k]eep them from sinking in [the] middle of their Length.

[B]y the Act of Parliament for [the] rebuilding of *London*, it is [prov]ided, that all Purlins from [15] Foot 6 Inches to 18 Feet [6 In]ches long, ought to be in [thei]r Square 9 Inches and 8 In[ches]: And all in length from [18] Foot 6 Inches to 21 Foot [6 In]ches, ought to be in their [Squ]are 12 Inches and 9 Inches.

[P]URBECK-STONE is a [har]d, greyish Stone, almost like [Ryg]ex-*Petties*, they are used [for] Pavements.

[A]s *to the Price*, it is commonly sold in Slabs (ready polish'd for Chimney-foot Paces) for 2 *s. per* Foot. And Purbeck paving of promiscuous Sizes, only hew'd and squar'd is sold for about 7 *d. per* Foot; also Mitchels are valued at about 1 *s.* 10 *d. per* Foot.

PUTLOGS [in *Carpentry*] are short pieces of Timber (about 7 Foot long) used by Masons in building Scaffolds to work upon. The Putlogs are those pieces that lie at right Angles to the Wall, or horizontal to the Building, with one of their Ends resting on the Ledgers of the Poles, which are those pieces that lie parallel to the side of the Wall of the Building.

PYCNOSTYLE } [In an-
PYCHNOSTYLE } cient *Architecture*] is a Building where the Columns stand very close one to another; one Diameter and a half of the Column being allow'd for the Intercolumniations.

The *Pycnostyle*, is the smallest of all the Intercolumniations mentioned by *Vitruvius*.

Some make the *Pycnostyle* the same with the *Systyle*; others distinguish the latter by its allowing half a Module more in the *Corinthian* intercolumniations.

Mr. *Evelyn* observes, that the *Pycnostyle* chiefly belonged to the *Composite* Order; and was used in the most magnificent Buildings, as at present in the *Peristyle* of St. *Peter*'s at *Rome*, consisting of near 300 Columns; and such as yet remain of the Ancients, among

the late discovered Ruins of *Palmira*.

PYLING the Ground for Foundation.

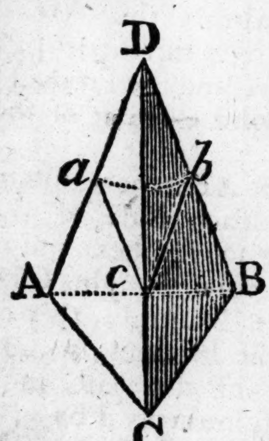
PYRAMID [in *Geometry*] is a Solid standing on a square Basis, and terminating at Top in a point: Or it is a Body whose Base is a *Polygon*, and whose Sides are plane Triangles; the several Tops meeting together in one point.

The Properties of a Pyramid are,

1. All *Pyramids* and Cones standing on the same Base, and having the same Altitude, are demonstrated to be equal.

2. A Triangular *Pyramid* is the third part of a Prism standing on the same Base, and of the same Altitude.

3. Hence, since every Multangular may be divided into Triangulars. Every Pyramid is the third Part of a Prism standing on the same Base, and of the same Altitude.



4. If a *Pyramid* be cut by a Plane *abc*, parallel to its Base ABC, the former Plane or Base will be similar to the latter.

5. All Pyramids, Prisms, Cylinders, &c. are in a Ratio compounded of their Bases and Altitudes, the Bases therefore being equal, they are in Proportion to their Altitudes; and the Altitudes being equal in Proportion to their Bases.

6. *Pyramids*, Prisms, Cylinders, Cones, and other similar Bodies are in a triplicate Ratio of their homologous Sides.

7. Equal *Pyramids*, &c. reciprocate their Bases and Altitudes, *i. e.* the Altitude of the one, is to that of the other; as the Base of the one, to that of the other.

A *Sphere* is equal to a *Pyramid*, whose Base is equal to the Surface, and its Height to the Radius of the Sphere.

8. A *Pyramid* is one third of the perpendicular Altitude multiply'd by the Base.

To measure the Surface and Solidity of a Pyramid.

Find the Solidity of a Prism that has the same Base with the given Pyramid, and divide this by 3; the Quotient will be the Solidity of the Pyramid.

Suppose *v. gr.* the Solidity of the Prism be found 670103[...] the Solidity of the Pyramid w[...] be thus found 226336770.

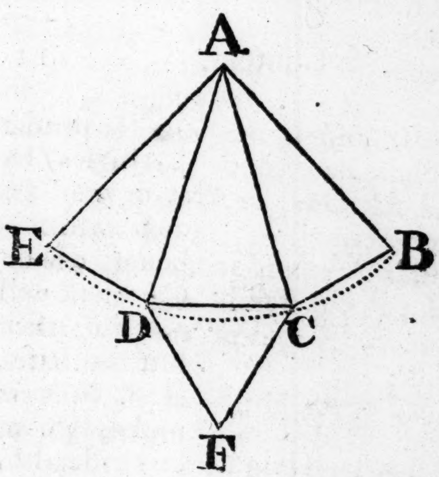
The Surface of a Pyramid [...] had by finding the Areas bo[...] of the Base ABC and of th[...] lateral Triangles ACD, CB[...] and BDA, the Sum of these [...] the Area of the Pyramid.

The external Surface of [...] right Pyramid standing on a [...]gular Polygon Base, is equal [...] the Altitude of one of the T[...] ang[...]

ngles which compose it, multiplied by the whole Circumference of the Base of the Pyramid.

To describe a Pyramid, on a Plane.

First draw the Base *v. gr.* the Triangle ABC (if the Pyramid required, be Triangular) so as that the Side AB suppos'd to be turned behind, be not express'd. 2. On AC and CB, construct the Triangles ADC, and CDB, meeting in any assumed or determined Point, *v. gr.* D, and draw AD, CD, BD, then will ADBC be a Triangular Pyramid.



To Construct a Pyramid of Paste-Board, &c.

Suppose, *v. gr.* a Triangular Pyramid required.

1. With the Radius AB, describe an Arch BE, as in the Figure, and thereto apply three equal Chords BC, CD and DF.

2. On DC construct an equilateral Triangle DFC, and draw the Right-lines AD and AC, this Paste-board, *&c.* being cut off by the Contour of the Figure, what remains within will turn up into a Pyramid.

To find the Solid Content of a Pyramid.

The RULE.

Multiply the Area of the Base by a third part of the Altitude, and the Product will be the Solid Content of the Pyramid.

Let ABD be a square Pyramid, each Side of the Base being 18.5 Inches, and the perpendicular Height CD is 15 Feet: Multiply 18.5 by 18.5, and the Product is 340.25 the Area of the Base in Inches, which multiply'd by 5, a third Part of an Inch, and the Product of that will be 1711.25, this being divided by 144, the Quotient will be 11.88 Feet.

```
        18.5
        18.5
      ------
        925
      1480
      185
  ----------
      342.25 Area of Base.
           5
      ------
144)1711.25(11.88 Content.
```

By Scale and Compasses.

Extend the Compasses from 12 to 18.5 Inches, that Extent turn'd twice over from 5 Feet (a third Part of the Height) will fall at least upon 11.88 Feet, the solid Content. *Pl.* 2. *Fig.* 1.

To find the Superficial Content.

Multiply the slanting Height

```
        180.24
            37
      --------
        126168
        54072
      --------
144)6668.88(46.31
    576         2.38
    ----       -----
     908       48.69
     864
    ----
      448
      432
     ----
      168
      144
     ----
       24
```


F.		I.		P.
1	:	6	:	6
1	:	6	:	6
1	:	6	:	6
		9	:	3
				9.[illegible]
2	:	4	:	6.[illegible]
				5
11	:	10	:	7.[illegible]

(or Perpendicular of one of th[e] Triangles) by half the Periph[e]ry of the Base 37, and the Pro[duct] will be 6668.88, whi[ch] being divided by 144, th[e] Quotient will be 46.31 Fee[t] the Superficial Content of a[ll] but the Base; then to that ad[d] 2.38 Feet the Base, and [it] makes 48.69 Feet, the who[le] Superficial Content.

```
144)342.25(2.38
    288
    ----
     542
     432
    ----
     1105
     1152
```

By Scale and Compasses.

Extend the Compasses from 4 to 180.24, and that Extent ill reach from 37 to 46.31 et, the Area of the four Tri- gles; and extend the Com- sses from 144 to 18.5 (one de of the Base) that Extent ill reach from 18.5 to 2.38 re; which added to the other, e Sum is 48.69, the whole perficies.

Demonstration.

Every Pyramid is a third art of a Prism, which hath e same Base and Height (by *uclid* 12.7.)

That is, the Solid Content of e Pyramid ABD, is one third art of its circumscribing Prism BEF.

For every Pyramid which s a square Base (such as *a*B*b* in the Figure) is con- ituted of an infinite Series of quares, whose Sides or Roots e continually increasing in A- thmetical Progression, begin- ing at the Vertex or Point D, s base A*a*B*b* being the great- t Term, and its Perpendicu- r Height CD is the Number f all the Terms; but the last erm multiplied into the Number of Terms, the Product ill be triple the Sum of all e Series; consequently $\frac{NLL}{3}$ = *S*.

And *S* is equal to the Solid Content of the Pyramid.

From hence it will be easy to conceive, that every Pyra- mid is a third of its circumscri- bing Prism (that is of a Prism of equal base and Altitude) of what form soever its base is of, *viz.* whether it be Square, Tri- angular, Pentangular, &c.

You may very easily prove a Triangular Pyramid to be a third part of a Prism of equal Base and Altitude, by cutting a Triangular Prism of Cork, and then cut that Prism into three Pyramids; by cutting it diagonally.

A *Triangular* PYRAMID, Let ABC, be a Triangular Pyramid, each Side of the Base being 21.5 Inches, and its per- pendicular Height 16 Feet, the Content both Solid and Superfi- cial is desired. *Plate* 2. *Fig.* 2.

First, find the Area of the Base, by multiplying half the Side by the Perpendicular, let fall from the Angle of the Base to the opposite Side; which Perpendicular will be found to be 18.62, the half of which is 9.31, which multiplied by 21.5, the Product will be 200. 165 Inches the Area of the Base; then because the Altitude 16 cannot be exactly divided by 3, therefore take a third Part of 200.165, which is 66.72, and multiply it by 16, and the Product will be 1067.52, which divided by 144, the Quotient will be 7.41 Feet, the Solid Content.

9.31 Half Perp.
21.5 The Side

4655
931
1862

3)200.165 Area Base

66.72 a third Part
16 Height

40032
6672

144)106752(7.41 Solid Content.
1008

595
576

192
144

48

	F.	I.	P.
Side	1 :	9 :	6
Half Perpend.		9 :	4
	1 :	4 :	1 :
			7 :
Area Base	1 :	4 :	8 :
	5 :	6 :	10 :
3)	22 :	3 :	6 :
	7 :	5 :	2 :

N.B. In casting up this by Feet and Inches, instead of multiplying by 16 the Height, I divide 12 into such 4 Numbers as being multiplied together, the Product may be 16, as 4 and 4, and multiply first by one and then by the other, and a third part of the last Product is the Content.

By Scale and Compasses.

First, find a Geometrical mean Proportional (as before directed) by dividing the Space between 21.5 and 9.31, into two equal Parts, and you will find the middle Part at 14.15, whi[ch] is the mean Proportional sough[t].

Then extend the Compass[es] from 12 to 14,15, and that Ex[-] tent (turn'd twice over from 1[6]) will fall at last upon 22.23, [a] third of which is 7.41 Feet, th[e] Content.

To find the Superficial Content.

Multiply the slant Heig[ht] (or Perpendicular of one of th[e] Triangles) by half the Per[i-] phery of the Base, and to th[e] Product add the Area of th[e] Base, and the Sum will be th[e] whole Superficial Content.

192.1 I

192.1 Inches the slant Height at D.
Half Periph. 32.25 = 21.5 + 10.75

```
      9605
     3842
    3842
   5763
   --------
   6195.225 Inches the Area of all but the Base.
    200.165 Area of the Base, add
   --------
144 ) 6395.390 ( 44.41 Feet the whole Content.
      576
      ---
       635
       576
       ---
        593
        576
        ---
         179
         144
         ---
          35
```

By Scale and Compass.

Extend the Compasses from 144 to 192:1, that Extent will reach from 32.25 (half the Periphery of the Base) to 43.02 Feet, the Content of the upper Part.

And extend the Compasses from 144 to half the Perpendicular 9.31, that Extent will reach from the Side 21.5, to 1.39 Feet, the Area of the Base, which being added to the other, makes 44.41 Feet, the Content of the Whole.

Let A B C D E F G H be Pyramid, whose Base is a *Heptagon*, each Side thereof being 15 Inches, and the Perpendicular of the *Heptagon* is 15.58 Inches, and the Perpendicular Height of the Pyramid H I is 13.5 Feet; the Content Solid and Superficial is requir'd. See *Plate* 2. Fig. 3.

Multiply 15.58 (the Perpendicular) by 52.5. half the Sum of the Sides of the *Heptagon*, and the Product is 817.95, which multiply'd by 4.5. *viz.* $\frac{1}{3}$ of the Height, and the Product will be 3680.775.

Then divide this last Product by 144, and the Quotient will be 25.56 Feet, the Content.

15.58

15.58 the Heptagon's Perpendicular.
52.5 the half Sum of the Sides.

7790
3116
7790

817.950
4.5 a third Part.

4089750
3271800

144)3680.7750(25.56 Solid Feet.
288

800
720

807
720

877
864

13

By Scale and Compasses.

First, Find a Geometrical mean Proportional between 15.58 and 52.5 (as is before directed) which you will find to be 28.06; then extend the Compasses from 12 to 28.6, and that Extent will reach from 4.5 (twice turn'd over) to 25.56 Feet.

To find the Superficial Content

Multiply the Height taken from the middle of one of the Sides of the Base 162.75 Inches, by the half Sum of the Sides 52.5 Inches, and the Product will be 8544.375; which divided by 144, the Quotient will be 59.335 Feet, the Content of the upper Part.

162.75
52.5

81375
32550
81375

144)8544.375(59.335 Feet.
568 Base add

1344
483
517
855

135

65.015 the whole Content.

By Scale and Compasses.

Extend the Compasses from 4 to 162.74, and that Ex- nt will reach from 52.5 to 9'335 Feet.

And extend the Compasses om 144 to 15.58 the Perpen- cular of the *Heptagon*, and e Extent will reach from 5.25 5.68 Feet the Content of the se; which add to the former, d the Sum will qe 65.015, e whole Superficial Content.

PYRAMID [in *Architec- re*] is a solid massive Edifice ich from a Square Triangu- , or other Basis, rises dimi- hing to a Point or Vertex.

Pyramids are sometimes used preserve the Memory of gular Events; and some- nes to transmit to Posterity Glory and Magnificence of inces. But as they are a mbol of Immortality, they more commonly us'd as Fu- al Monuments.

Such is that of *Cestius* at

P Y

144)817.95(5.68
979
1155

3

Rome, and those other celebrated ones of *Egypt*, as famous for the enormousness of their Size as their Antiquity.

Those of *Egypt* are all square in their Bases, and it is a thing has been frequently propos'd, to establish a fix'd Measure from them, to be thereby transmitted to Posterity.

The Pyramid is said to have been among the *Egyptians* an Emblem or Symbol of human Life; the Beginning of which is represented by the Base and the End by the Apex, on which account it was they us'd to erect them on Sepulchres.

1. A Pyramid is one third of the perpendicular Altitude multiply'd by the Base.

2. The Superficial Area of a Pyramid is found by adding the Area of all the Triangles, whereof the Sides of the Pyramid consist, in one Sum.

3. The external Surface of a right Pyramid which stands on a regular Polygon Base, is equal

equal to the Altitude of one of the Triangles which compose it, multiply'd by the whole Circumference of the Base of the Pyramid.

A Pyramid should be raised to such a Height as may set it above all the Buildings that accompany it; so that it may be viewed out of the Country, and be a noble Ornament to the City that raised it.

A Pyramid, says M. *le Clerc*, should always be single, or alone, otherwise it looses its proper Signification, which is to represent the Glory of the Prince.

PYRAMIDAL *Numbers*, are the Sum of polygonal Numbers collected after the same manner as the polygon Numbers themselves are extracted from Arithmetical Progressions; they are distinguished into *first*, *second*, *or third Pyramidals*.

PYRAMIDOID, is what is sometimes called a *Parabolic Spindle*, and is a solid Figure, form'd by the Revolution of a Parabola round its Base or greatest Ordinate.

Q

QUADRA [*in Building*] is any square Border or Frame incompassing a Basso, Relievo, Pannel, Painting, or other Work: It is also us'd (but erroneously) for a Frame or Border of another Form, as round, oval, or the like.

QUADRANGLE [in *Geometry*] a Quadrangular or Quadrilateral Figure, or a Figure which has four Sides and four Angles. To the Class of Quadrangles belong, the *Square*, *Pa-rallellogram*, *Trapezium*, *Rhom-bus*, and *Rhomboides*.

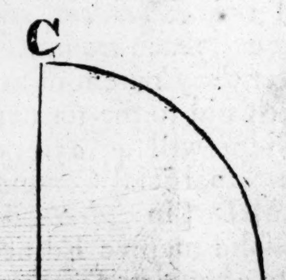
QUADRANT [in *Geome-try*] is an Arch of a Circle con-taining 90 Degrees, or one 4th of the intire Periphery; an is also the Space contained be-tween a quadrantal Arch an two Radii perpendicular o to another, in the Center o a Circle.

QUADRANT is the fourt Part of a Circle.

To find the *Area* this is

The RULE.

Multiply half the arch Li of the Quadrant, (that is, th eighth part of the Circumfe rence of the whole Circle) b the Radius, and the Produ is the Area of the Quadrant.

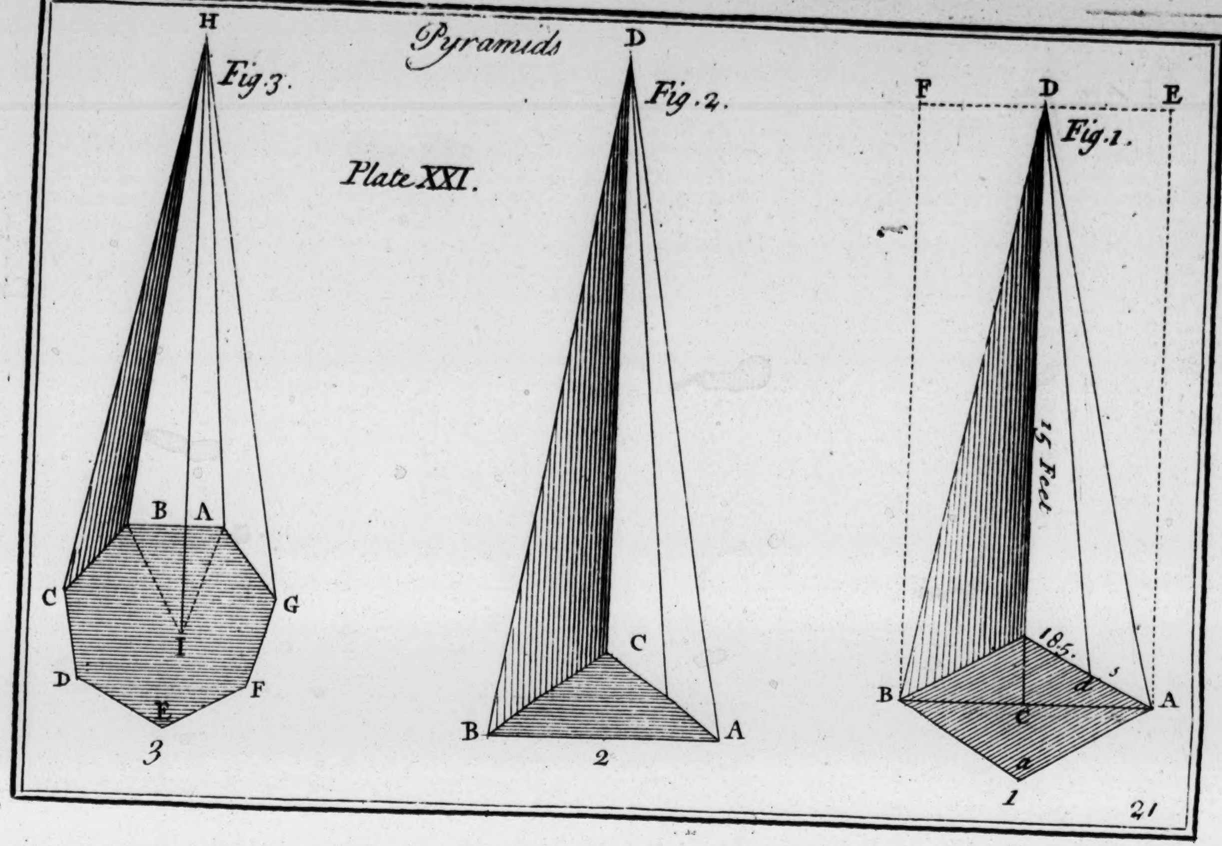


Let *ABC* be a Quadrant fourth part of a Circle, wh Radius or Semidiameter is 11 and the half arch Line 8,87 these multiply'd together, t Product is 100.2875 for the A rea.

These are the Rules a Ways commonly given for fi ing the Area of a Semici

Pyramids

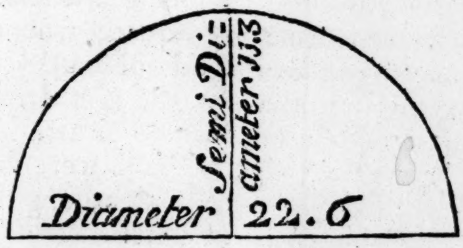
Plate XXI.



d Quadrant; but I think it as good a way to find the Area the whole Circle, and then take half that Area for the emicircle, and a fourth part r the Quadrant.

To find the Area of a Semicirc, *this is the* Rule.

Multiply the fourth part of the Circumference of the whole Circle, (that is, half the arch Line) by the Semidiameter, and the Product will be the Area.



Let *ABC* be a Semicircle, hose Diameter is 22.6, and the alf Circumference or arch ine *ACB* is 35.5, the half of which is 75.5, which multiply by the Semidiameter 11.3, and the Product will be 200.575, the Area of the Circle.

$$
\begin{array}{r}
17.75 \\
11.3 \\
\hline
5325 \\
1775 \\
1775 \\
\hline
200.575
\end{array}
$$

The Area of the Semicircle.

By Scale and Compasses.

Extend the Compasses from to 11,3, and that Extent will each from 17.75 to 200.575, he Area.

If only the Diameter of the emicircle be given, you may ay by the Rule of Three, as is to 3927, so is the Square of he Diameter to the Area.

By Scale and Compasses.

Extend the Compasses from 1 to the Diameter 22.5, and that Extent turned twice over from 3927, will reach at last to 200.575.

QUADRAT or *Line of Shadows on a Quadrant*, are only a Line of natural Tangents to the Arches of the Limb, and are plac'd there in order to measure Altitudes readily; for it will always be, as the Radius to the Tangent of the Angle of Altitude, at the Place of Observation (that is, to the parts of the Quadrats or Shadows cut by the

the String) so is the Distance between the Station and the Foot of the Object, to the Height above the Eye.

QUADRANTAL *Triangle*, is a Spherical Triangle, one of whose Sides (at least) is a Quadrant, and one right Angle.

QUADRATRIX [in *Geometry*] is a mechanical Line, by the Means whereof we can find right Lines equal to the Circumference of a Circle or other Curve, and the several Parts thereof.

QUADRATURE [in *Geometry*] is the squaring, or reduction of a Figure to a Square, or the finding a Square equal to a Figure proposed.

Thus the finding of a Square containing just as much Surface or Area, as a Circle, an Ellipsis, a Triangle, or other Figure, is call'd the *Quadrature* of a Circle, an Ellipsis, a Triangle, or the like.

The *Quadrature* of Rectilinear Figures comes under the common Geometry; as amounting to no more than the finding their Area's or Superficies, which are in Effect their Squares.

The *Quadrature of Curves*, that is, the measuring of their Area, or the finding of a rectilinear Space equal to a curvilinear Space, is a Matter of much deeper Speculation, and makes a Part of the higher Goometry.

QUADRATURE *Lines* are two Lines frequently placed on *Gunter*'s Sector.

They are mark'd with the Letter Q, and the Figures 5, 6, 7, 8, 9, 10, of which Q signifies the Side of a Square, and the other Figures the Sides of Polygons of 5, 6, 7, &c. Sides. S there stands for the Semidiameter of a Circle, and 90 for a Line equal to 90 degrees in the Circumference.

QUADREL [in *Building*] a sort of artificial Stone perfectly Square, whence their Name, made of chalky, white, pliable Earth, &c. dried in the Shade for two Years.

These were formerly in great request among the *Italian Architects*.

QUADRIPARTITION a dividing by four.

QUADRUPLE a Sum or Number multiply'd by 4, or taken four times.

QUADRILATERAL *Figures*, are those whose Sides are four Right Lines, and those making four Angles, as *Parallelogram*, *Trapezium*, *rectangle Square*, *Rhomboides or Rhombus*.

QUANTITY signifies whatsoever is capable of any Sort of Estimation or Mensuration, and which being compar'd with another thing of the same Nature, may be said to be greater or less, equal or unequal to it.

The Quantity of Matter in any Body, is its Measure arising from the Joint Consideration of its Magnitude and Density.

2. The Quantity of Motion in any Body, is its Measure arising from the Joint Consideration of the Quantity of Matter in, and Velocity of the Motion in that Body.

QUARRELS *of Glass* } [in
QUARREYS } *Glaziery*]

iery] a Pane or Piece of Glaſs ut in a Diamond Form.

They are of two Kinds, *viz.* quare and Long, each of hich is of different Sizes, expreſs'd by the Number of them hich makes a Foot, *viz.* 8ths, oths, 12ths, 15ths, 18ths and oths; but all the Sizes are cut the ſame Angles, the Acute ngle being 77 Degrees 19 Min. the Square Quarrels, and 67 Degrees 21 Minutes in the Long ones.

QUARRY, a Place under Ground, out of which are dug Marble, Free-ſtone, Slate, Lime-Stone, and other Matters proper for Building.

In the digging Quarries of *Free-ſtone*, they firſt open a Hole the Manner of a Well, 12 or 14 Foot in Diameter, drawing p the rubbiſh with a Windlaſs large Oſier Baſkets, they eap it up all around, and Place he Wheel, which is to draw up he Stones upon it.

As the Hole grows deeper, nd their common Ladder too hort, they apply a particuar Ladder for their Purpoſe: when they are got through the Earth, and are arrived at the irſt Bank or *Stratum*, they begin to uſe their Wheel and Baſkets, to diſcharge the Stones s faſt as they dig through them.

There are uſually ſeven of heſe different Beds or Strata of Stones found of different Heights nd ſerving for different Purpoſes; tho' the Number, as well s the Order in which they folow, is various.

As to the drawing of the Stone, . e. freeing it from the Beds, they find that common Stones, at leaſt thoſe that are of the ſofter Kinds, as they lie, have two Grains, a cleaving Grain, running Parallel with the Horizon, and a breaking Grain, Perpendicular thereto.

After they have uncop'd the Stone, *i. e.* cleared it of the Earth, they obſerve by the Grain where the Stone will cleave, and there they drive in a good Number of wedges, till they have by this Means clear'd it from the Reſt of the Rock.

They then proceed to break it; in Order to which they apply a Ruler to it at both Ends about 10 or 12 Inches apart, according to the Uſes the Stone is intended for, and ſtrike a Line, and by this cut a little Channel with their Stone Ax; and ſet five or ſix wedges, (ſuppoſing the Stone to be three or four Foot) driving them in very carefully, with gentle Blows, and ſtill keeping them equally forward.

When they have broke them in Length (which they are able to half an Inch of any Size) applying a Square to the Streight Side, they Strike a Line and proceed as before to break it in Breadth alſo.

This Method of drawing is found greatly preferable to that where the Stones are broken at Random, one Load of the Stones drawn after this Manner, being found to do the Buſineſs of a Load and a Half of the latter.

But this cleaving Grain being ſeldom found in the harder Stones they uſe great heavy Stone Axes only for breaking up theſe

in the Quarries, with which they Work down a deep Channel into the Stone, and lay two Bars of Iron a Top into this Channel, and drive their Iron Wedges between these Bars.

Some, in drawing of Stone, especially those of a very hard Kind, make use of Gunpowder, and to a very good Effect.

Their Method is as follows, they make a small Perforation pretty deep into the Body of the Rock, so as to have that thickness of Rock proper to be blown up at once; at the further End of the perforation they lay a proper Quantity of Gunpowder, filling up all the Rest with Stones and Rubbish strongly ramn'd in, except a little Space for the Train.

By this Means is the Rock blown up into several Pieces, most of them not too unwieldy for the Workmen to manage.

QUARTER *Round* [in *Architecture*] signifies any Moulding in general, whose contour is either a perfect Quadrant or Quarter of a Circle, or that approaches near to that Figure. Architects commonly call it *Ovolo*, and *Vitruvius Echinus*.

QUARTERS [in *Architecture*] are those slight upright Pieces of Timber placed between the Punchions and Posts, used to lath upon.

They are of two Sorts, *single* and *double*; the *single* Quarters are sawn Stuff two Inches thick and four Inches broad; the *double* Quarters are sawn to four Inches Square.

'Tis a Rule in Carpentry, that no Quarters be placed at greater Distance then fourteen Inches.

QUARTERING [in *Carpentry*] signifies the putting in of Quarters. Sometimes it is used for the Quarters themselves.

QUINDECAGON, is a plain Figure of fifteen Sides and Angles, which, if they are all equal to one another, is call'd a *regular Quindecagon*.

Euclid shows how to describe it in a Circle. *Prop.* 16. *c.* 4.

The Side of a *regular Quindecagon* so described is equal in Power to the half Difference, between the Side of equilateral Triangle, and the Side of the *Pentagon*; and also to the Difference of the Perpendiculars let Fall on both Sides taken together.

QUINQUEANGLED [in *Geometry*] is said of a Figure consisting of five Angles.

QUINTUPLE five Fold or five Times as much as another Thing.

QUIRK [with *Builders*] a Piece of Ground taken out of any Ground Plot or Floor— Thus if the Ground Plot were Square or Oblong, and a Piece be taken out of a Corner to make a Court or Yard, &c. the Piece is call'd a Quirk.

QUOINS [in *Architecture*] are set in the Corners of Brick or Stone Walls.

The Word is particularly used for Stones in the Corners of Brick Buildings.

Rustick-Quoins, are those which stand out beyond the Bric

k Work, (their Edges be- chamfer'd off.)

These latter at two Foot one e, and one Foot the other, valued from 1 *s.* to 1 *s.* *per* Quoin, Stone and Work- ship.

UOTIENT [in *Arith- ck*] is that Number in a sion, which arises by divi- the Dividend by the Divi- and is call'd the *Quotient*, use it answers to the Ques- how often one Number is ain'd in another.

R

BBETING [in *Carpen- try*] is the planing or cut- of Channels or Groves in ls.

RAFTERS [in *Building*] are pieces of Timber, which stand by Pairs upon the Rea- son, meet in an Angle at the Top, and help to compose the Roof of a Building.

As to their Scantlings, *&c.* it is provided by an Act of Par- liament for Re-building the City of *London*, that the fol- lowing Scantlings, (which were well consulted by the ablest Workmen before they were re- duced to an Act) are set down as fitted for all Edifices great or small, as follows.

As to their Distance, 'tis a Rule in *Architecture*, that no Rafters be laid at greater Dis- tance from each other than 12 Inches.

From		to		Must be in Breadth.		And thick.
F.	I.	F.	I.	Foot.	Top.	
12	6	14	6	Inches	Inches	Inches.
14	6	18	6	8	5	6
18	6	21	6	9	7	7
21	6	26	4	10	8	8
24	6	26	4	12	9	8½
				13	9	9

Rafters in Length— { 6 Foot 6 Inches / 8 next / 9 next } must

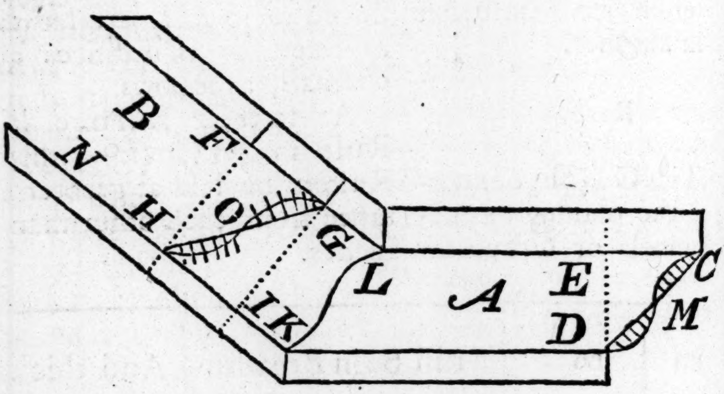
in their Square — { 4 and 3 / 4½ and 3¾ / 5 and 4 } Inches

Principal RAFTERS, should be near as thick at the Bottom as the Beam, and should diminish in their Length one fifth, or one sixth of their Breadth, the king Posts should be as thick as the principal Rafters, and their Breadth according to the Bigness of them that are intended to be let into them, the middle Part being left something broader than the Thickness.

RAG-STONE, see *Pavin*

RAKEING. Suppose t Level Moulding A join t rakeing Moulding B. How make their Curves to fit ea other at their Mitering L K.

Draw the Moulding or Cur C D, also the Right Line C which divide into halves in and divide the Right Li D M and M C, each into a Number of equal Parts (t more the better.



From thence raise Perpendiculars to the Curves, as in the Example; and draw the Line D E Perpendicular to D K.

When you have done this, draw the Line G I and H F Perpendicular to K N, and distant from each other, equal to E C, and draw the Line H G, which divide in the middle in O.

Then divide H O into the same Number of Parts as D M, and also O G as M C, from whence raise Perpendiculars at Pleasure, as in the Example.

When you have so done, take the Length of the Perpendiculars between the Right Line and the Curve Line D M, and set them on their respective P pendiculars on the Right L H O; that is, set the L next to D on the Line next and so on to the Perpendicu on M C and O G, whose Po create the true Curve H O by sticking a Nail into e Point, and bending a thin L to touch them all at o whose Edge gives the Curv moulding requir'd.

N. B. This Method is ful in all Pediments or R ing Work whatsoever, and prevent that common E which Workmen call tu off, after the Work is pu gether.

RA

RAILS [in *Architecture*] re used in different Senses, as articularly for those Pieces of Timber, *&c.* which lie horiontally between the *Pannels* f Wainscot; also for those hich lie over and under Balsters in Balconies, Stair-cases, nd the like; and also to ieces of Timber, which lie orizontally from Post to Post Fences, with Pales or withut.

Mr. *Wing* says, that the Price f making Rails and Ballusters Balconies, or about the Platrm of great Houses are worth for Workmanship only) 4 *s.* r Yard, running Measure.

RAISER [in *Building*] a oard set on Edge, under the reside of a Step, Stair, *&c.*

RAISING *Pieces* [in *Architure*] are Pieces that lie uner the Beams, on Brick or imber by the Side of the ouse.

RANGE [in *Building*] the de of any Work that runs ait, without breaking out to Angles, is said to range run range: Thus the Rails d Pannels of one Side of ainscotting is said to run range.

RATIO or REASON [in *rithmetick* and *Geometry*] is at Relation of homogeneous hings which determines the uantity of one from the Quany of another, without the Internion of any third: Or it is hen two Quantities are comr'd one with another, with spect to their greatness or allness, that Comparison is lled *Ratio.*

RATIONAL *Quantity* or *Number*, is a Quantity or Number commensurable to Unity.

As, supposing any Quantity to be 1, there are infinite other Quantities, some of which are commensurable to it, either simply or in Power, and these are called by *Euclid Rational Quantities*; and the rest that are incommensurable to 1, he calls *Irrational Quantities.*

RATIONAL *Integer, or Whole Number*, is that of which Unity is an Aliquot Part.

RATIONAL *Fraction or Broken Number*, is that which is equal to some Part or Parts.

RATIONAL *Mix'd Number*, is that which consists of a Mix'd Number and a Fraction.

RAY [in *Opticks*] a Line of Light propagated from a Radiant, through an unresisting Medium.

Common RAY [in *Opticks*] is sometimes us'd for a Rightline drawn from the Point of the concourse of the two optical Axes, through the middle of the Right-line, which passes by the Center of the Pupil of the Eye.

PRINCIPAL RAY [in *Perspective*] is the perpendicular Distance between the Eye and the vertical Plane or Table, as some call it.

RECIPROCAL *Figures* [*in Geometry*] are such as have the Antecedents and Consequents of the Ratio in both Figures.

RECIPROCAL *Proportion* is when in four Numbers, the fourth is lesser than the second, by so much as the third is greater than the first; and *vice versa.*

RECTANGLE [in *Arithmetick*] is the ſame with Product, which ſee.

RECTANGLED, as a *Rectangled Triangle*, is a Triangle one of whoſe Angles is Right or equal to 90 Degrees.

There can be but one Right-angle in a Plain Triangle; therefore a rectangled Triangle cannot be equilateral.

RECTANGULAR [in *Geometry*] is applied to Figures and Solids, which have one or more Angles right.

RECTILINEAR [in *Geometry*] i. e. *Right lined*, is applied to Figures, whoſe Perimeter conſiſts of Right-lines.

REDUCT [in *Building*] a Querk or little Place taken out of a larger, to make it more uniform and regular: or for ſome Conveniencies, as for little Cabinets on the Sides of Chimneys, Alcoves, *&c.*

REDUCTION [in *Arithmetick*] is the converting Monies, Weights and Meaſures, into the ſame Value in other Denominations, *ex. gr.* Pounds into Shillings and Pence, *&c.*

REFLECTION in general, is the Regreſs or Return, that happens to a moving Body, becauſe of the meeting of another Body, which it cannot penetrate; thus the material Rays are reflected variouſly from ſuch Bodies as they cannot paſs through.

REFLEX } [in *Painting*] is underſtood of thoſe Places in a
REFLECT } Picture, which are ſuppoſed to be illuminated by a Light, reflected by ſome other Body repreſented in the ſame Piece.

REFLEX *Viſion* } [in *Catoptricks*] is that which is per-
REFLECTED *Viſion* } formed by means of Rays reflected from poliſh'd Surfaces of Objects to the Eye.

REFRACTION [in *Mechanicks*] in General, is the Incurvation or change of Determination in the Body moved, which happens to it while it enters or penetrate any Medium.

REFRACTION [in *Dioptricks*] is the Variation of a Ray of Light, from that Right-line which it would have paſſed in, had not the Denſity of the Medium turn'd it aſide.

REFRACTION *from the Perpendicular*, is when a Ray falling inclin'd, from a thicker Medium into a thinner, in breaking departs from that Perpendicular.

REFRACTION *to the Perpendicular*, is when it falls from a thinner into a thicker, and ſo becomes nearer the Perpendicular.

REGULA [in *Architecture*] See *Orlo*.

REGULAR BODIES are Solids, whoſe Surface is compos'd of regular and equal Figures; whoſe Solid Angles are all equal, ſuch as the *Tetrahedron*, *Hexahedron*, *Octahedron*, *Dodecahedron*, and *Icoſahedron*.

There can be no more regular Bodies beſides theſe.

REGULAR *Figures* [in *Geometry*] are ſuch whoſe Sides and conſequently their Angles are all equal to one another: Whence all regular Multilateral

Planes

lanes are called *Regular Pogons*.

The Area of ſuch Figures is eedily found, by multiplying Perpendicular let fall from the enter of the inſcrib'd Circle to y Side, by half that Side; d then that Product by the umber of the Sides of the Pogon.

RELIEVO } [in *Sculpture*] RELIEF } is applied to a igure which projects or ſtands t, prominent from the Ground Plane whereon it is form'd; hether that Figure be cut ith a Chiſſel, moulded or ſt.

The *Alto Relievo* } is when High RELIEF } the Fire is form'd according to Nae, and projects as much as Life.

Baſſo RELIEVO } is Baſs or low RELIEF } en the Work is rais'd but little from its Ground, as in dals, Frontiſpieces, Feſtoons, liages, and other Ornaments Friezes.

Demi RELIEVO, is when half of the figure riſes from Plan, *i. e.* when the Body of figure ſeems cut in two, and one half of it is clapp'd upa Ground, when there are e Parts that ſtand clear out, ach'd from the reſt in a *Baſſo lievo*, then the Work is cal*Demi-Baſs*.

RELIEVO [in *Architec*e] is the Projecture of any nament.

Daviler obſerves, that this ht always to be proportion'd e Magnitude of the Buildit adorns, and the Diſtance hich 'tis to be viewed.

RELIEVO [in *Painting*] is a Degree of Force or Boldneſs wherewith the Figures ſeem at a due Diſtance, to ſtand out from the Ground of the Painting, as if they were really imboſs'd.

RENDERING [in *Building*] See *Pargeting*.

REPOSITORY, a Storehouſe, or Place where things are laid up and kept. *Architects* more particularly uſe it to ſignify ſuch a Place as is built for the laying up Rarities, either in Painting or any other Art.

RESERVATORY, a Place to which Waters are brought together, not only to make *Jet's d'eaux* one of the greateſt Ornaments of a Garden; but alſo for ſupplying a noble Seat with Water for Family Uſes. See *Reſervoir*.

If a Perſon ſhall be ſo happy as to find out Water in a Place for which he may conveniently make a Reſervatory, without the Help of Machines, much Expence will be ſav'd thereby; But if that be impoſſible to be done, of Neceſſity Recourſe muſt be had to *Hydraulick* Machines, in order to raiſe it from the Bottom of Pools into *Reſervatories*, that it may be afterwards let down into Gardens, Houſes, &c.

Theſe Machines are now much in Uſe, and many People prefer them before natural Water-Courſes, by Reaſon of the Quantity of Water they furniſh, and the nearneſs of the *Reſervatories*, and Conduits or Pipes.

Water is rais'd by different Machines; first, by Pumps and Horses; and Secondly the two Elements of Air and Water are us'd to turn Mills, and these are infinitely to be preferr'd; these Machines almost always furnishing us with Water, as may be said, Night and Day.

Those *Reservatories* that are made on the Ground are usually Parcels of Water or moist Channels, from whence the Waters are brought together in great Quantities; these are made deep, that they may contain the more, and not be so soon empty.

If these can be made near an House, it will be much better; but if there be a Necessity that the Reservatory be in the Fields, it must be surrounded with a Wall.

Those *Reservatories* that are rais'd above Ground, cannot be expected to be made as large as the others, nor of Consequence be capable of holding as much Water; the Difficulty to support them, and Charge of the Lead, wherewith to line them, not admitting of it; they are to be rais'd upon Arches or Stone Pillars, with Timber Work thereon to form the Bottom and Sides, which must be lin'd with strong Sheets of Lead, well soldered together. The Timber Work ought to be very solid and strong, that it may bear the great Weight of the Water.

The Ancients had 3 Ways for the Conveyance of Water, *viz.* Subterranean Aqueducts, Leaden Pipes, and Stone or Earthen Pipes; which are still in Use, and to which we may add those of Wood, Brass and Copper.

Subterranean Aqueducts ought to be built of Free-Stone, and cover'd over with Arches or flat Stones, to the End that the Sun may not have an Influence upon the Waters; If a Rock happens to be in the Way, it must be cut thorough, and if a Mountain obstructs the Passage, a Way must be made through it, and the Aqueducts must be carried on through them, and Props us'd of 50 Fathom long from Place to Place, in Order to give the Water a little Air; and as to the Bottoms and Vallies which interrupt the Level of the Conveyance, they are to be fill'd up with Rubbish and Heaps of Masonry, or with Arches and the like.

The Water runs into these Aqueducts after different Ways, either through Stone or Leaden Pipes, Free-Stone, Troughs, Trenches made of Lime and Cement or Clay.

There are sometimes Veins of Gravel or Gravel Stones naturally met with, through which the Water will run without any loss: Room ought always to be made or allow'd for two small Paths on each Side of these Troughs or Conveyances, that there may be a Passage along by them, if there be Occasion; and besides, there must an imperceptible Declivity be given to these Troughs, that the Water may the more easily run along.

The

These Sorts of Aqueducts e proper to collect Spring ater, and to convey it into a *eservatory*; for the Waters ing not clos'd up therein, as Pipes, they lose the Declivi- and the Force which they ght to have to mount up into e Air.

Leaden Pipes are the most mmodious for raising of Wa- r; you may make them rise, l and turn, without hurting e running of the Water thro' em: There are two Sorts of em, *viz.* cast and soldered pes.

The first are cast in Moulds; what Length you please, d are generally 12 Foot long; ey are made thicker than the lder'd ones, for Fear of Blows; d therefore are better and ore valued; but they cost ore by reason of their eight.

Soldered Pipes are only Sheets Lead, bended and soldered gether at the Junctures, the ggest Leaden Pipes not ex- ding six Inches Diameter; se are thrust into one ano- r and soldered: These are to burst and to waste, laid Earths that are full of Chalk.

Stone or *Earthen* Pipes was hird Way the Ancients had the Conveyance of Water, are those that cost the least yet will keep the best.

These Pipes are a Compo- on of baked Earth, like t of which they make then and Stone Pots; they the Bodies of them, which two or three Feet long to another; and make Use of Mastick with some Hemp or Flax for the Junctures.

When these Pipes are made Use of for the Conveyance of forc'd Waters, they encompass them with a Lay of Cement, five or six Inches thick, which will preserve them a long time, provided they have the Precaution; first, to let the Conduit dry for several Months, before the Water is turn'd into it; that so the Cement may have Time to harden: And secondly, to secure these Pipes which are very brittle, with some Brick Work, so that they may not sink down too much.

These Pipes are more proper for the Conveyance of the Discharges of Basons, than spouting Water, which they cannot long be able to bear; they are subject to Fox-Tails, which are very small Roots, which passing through the Pores of the Earth or Stone, or through the Mastick which rots in the Ground, are fed by the Water and become so thick and long, that they intirely stop the Pipe.

There are some who pretend that the Fox-Tail comes from the Hemp that is us'd with the Mastick for the Junctures, or else from some Seeds, which with the Water got into the Pipe.

Stone or Earthen Pipes are particularly valued, for the Conveyance of Spring Water to drink; for being glaz'd on the inside, the mud will not stick to them, and the Water is better preserv'd and clearer than in other Pipes; besides that it does not acquire that ill

Quality in paſſing through them, as it does through Lead or Iron.

For making wooden Pipes, they take large Trees of Oak, Elm or Alder, and the ſtraiteſt that can be got; they bore them thorough and make a Channel of three or four Inches Diameter: they frame them after ſuch Manner, that the End of the one may be thruſt into the other, and bind them with an Iron Hook or Circle, and cover the Junctures with Pitch.

Theſe Sort of Pipes are good in Marſhy Grounds, and ſuch as are naturally moiſt; for they ſoon periſh in thoſe that are dry.

The Water that paſſes thro' them, M. *Chomel* ſays, is of a dark red Colour, and has always a particular Taſte.

Iron Pipes are caſt in Moulds, and are now much us'd; they have the ſame good Qualities as thoſe of Lead; they will laſt long, and coſt four or five times leſs Money.

Some of them are made to 18 Inches Diameter; each Pipe is three Foot and a half long, and there are Bridles at each End of them, which are join'd and cloſ'd together by Screws and Worms, between which they put Roundels of Leather and Maſtick.

As to the Proportion and Bigneſs of the Conduits and Pipes, in Reference to the *Jet d'Eau* or throwing of Water. It is upon that the Beauty of Spouting Water depends; for if the Pipes are too ſmall, or that they furniſh the Baſo[n] with too much Water, witho[ut] a juſt Proportion, they w[ill] form ſmall, weak and ill f[ormed] Caſts; beſides theſe Pipes a[re] ſubject to be eaſily choak'd u[p] and to burſt.

Now to play a *Jet d'Eau* [of] four or five Lines, that is o[ne] whoſe Ajutage is four or fi[ve] Lines Diameter, which form[s] a Paſſage of an Inch and th[e] ſeventh Part of an Inch in Ci[r]cumference, you muſt have [a] Pipe of an Inch and a half Di[a]meter: For a *Jet d'Eau* of ſi[x] or ſeven Lines, you muſt hav[e] a Pipe of 2 Inches; for one o[f] eight or nine Lines, a Pipe o[f] three Inches; and for a larg[er] *Jet d'Eau* of an Inch, a Pip[e] of four Inches Diameter; an[d] for a larger *Jet d'Eau* of 15 o[r] 16 Lines, you muſt have [a] thick Pipe of ſix Inches Dia[]meter.

It ſhould be held for a ge[]neral Rule, that the Paſſag[e] or Mouth of the Ajutage ſhould be four times leſs tha[n] the Opening or Diameter o[f] the Pipes of the Conduit; [to] the End that the Pillar of W[a]ter may be proportioned, an[d] that the Swiftneſs in the Pip[e] may be equal.

Add to this, that there mu[ſt] be too great a Friction in th[e] ſmall Conduits with Regard [to] great Ajutages, and in th[e] Brink or Edge of ſome Aj[u]tages, in reference to lar[ge] Conduits.

Note, that 12 Lines ma[ke] an Inch.

There are ſeveral Sorts [of] Ajutages; but the moſt co[m]m[on]

on are rais'd ones, and such s have but one Mouth or Passage; and they are also the est, and do not stop so often s the flat ones; which are ierced with several Holes or Clefts, plac'd opposite to one nother, or else they solder on veral other small Ajutages.

It is certain, that the larger e Conduits or Conveyance e, the better the Water passes; it is the Soul of good *Jets Eau*, which that they may be ell fed, should have a Conuit of the same Bigness, thro'-t from the *Reservatory* to e *Ajutage*, without Diminuon. This will furnish more ater, and give more Vigour the *Jet* or Cast, which witht will, as it were, be choak'd o afar off.

Some indeed are of a conary Opinion, and maintain at in a Conveyance of 100 athom long, it ought to be igger in the first 50 next the *eservatory*, than in the other o reaching to the *Ajutage*; d they pretend that the Diinution of the Bigness, should e about an Inch Diameter; to e End, say they, that the War may begin to be forced, and ent at a little Distance in the ipe, and which should always n with some Diminution to e very out-let of the Water. ut others again say, that they ave no solid Reason to support their Fancies.

There is but one Case only herein the Diameter of the onveyances ought to be diinish'd; and that is, when ey are so long as three or four hundred Fathom; then the Pipes are to differ thrice in Bigness, for without it, in the long Course the Water is to run, it will, as it were, sleep, and lose much of its Strength; but on the Contrary, the different Sizes revive and actuate it.

For Example, A Conduit that is 300 Fathom long, should have the first hundred of eight Inches Diameter, the next of six, and the last of four Inches Diameter.

But in those Conveyances or Pipes of 100 or 150 Fathom, you must continue the same Diameter throughout the whole Length, even to the Ajutage.

When there are several *Jets d'Eau*, as suppose five or six to be play'd in a Garden, it is not necessary that there should be five or six Conveyances or different Pipes made from the *Reservatory*, it would be a superfluous Charge, and contrary to all good Oeconomy: two or three are enough; but they must be of such Proportion and Bigness, as to be sufficient to supply all these *Jets d'Eau* with Water, in such a Manner that they may play all together equally, and without falling lower than one another.

Now to play three *Jets d'Eau*, each of which is from six to seven Lines in Diameter, your Pipe must be six Inches; and for three *Jets d'Eau* of four Lines, the Pipe must be four Inches; the Pipe they continue of the same Bigness till over against the Basons, or they diminish it proportionably by Bran-

Branches; and thus in a Pipe of six Inches, they make Branches of two Inches Diameter, to the End that the Water may be equally distributed for the Out-lets.

It is to be observ'd, that the End of the Pipe next the *Reservatoty*, ought to be two Inches or more in Diameter than the Rest: for Example, if a Pipe be four Inches in Diameter, the Sucker or Opening must be six Inches in the Bottom of the *Reservatory*, to the End that the Entrance being larger, it may serve for a Funnel for the Water to enter in more readily, and yield a greater Supply to the *Jets d'Eau*, you must make a Regard or Head, that is answerable in Bigness to the Diameter of the Pipe; and take Care that as much Water passes through the oval Hole of the Spout, and what some call the Bushel, as thro' the circular Hole of the Pipe.

RESERVOIR, a Place where Water is collected and reserv'd to be convey'd occasionally through Pipes, *&c.* or to be spouted up, *&c.*

The *Reservoir* is a Building or large Bason, usually of Wood lin'd with Lead, where Water is kept to supply the Occasions of the House.

At *Canons*, the noble Seat of the Duke of *Chandois*, is a very large *Reservoir*, a Top of the House, to which the Watsr is rais'd by a very curious Engine, contriv'd for the Purpose.

This *Reservoir* is so capacious, as that besides supplying all Parts of the House by Means of Pipes and Cocks, it likewise turns a Mill.

A *Reservoir* is also sometimes a large Bason of strong Masonry, glazed or paved at the Bottom: where the Water is reserv'd to feed *Jets d'Eau* or spouting Fountains.

Such is that vast one on the Top of *Marli* in *France*, call'd *Trou d'Enfer*, i. e. Hell-Mouth, whose Surface, *Daviler* tells us, contains 50 Acres, and its Depth such as under that Superficies to contain 100000 Cubick Fathom of Water.

RESOLUTION [in the *Mathematicks*] is a Method of Invention, whereby the Truth or Falshood of a Proposition, or the Impossibility is discovered, in an Order contrary to that of Synthesis or Composition.

RESSAUT [in *Architecture*] is the Effect of a Body, which either projects or sinks, *i. e.* stands more out or in than another; so as to be out of the Line or Level with it.

RETURN [in *Building*] is a Side or Part that falls away from the foreside of any strait Work.

RIBBING *Nails*, see *Nails*

RHOMBOIDES [in *Geometry*] a Quadrilateral figure, whose Sides and Angles are unequal, but the opposite ones equal; but is neither equilateral nor equiangular. Or,

A RHOMBOIDES is a Figure having four Sides, the opposite whereof are equal and parallel; and also four Angles, the opposite of which are equal.

To

find the Superficial Content.
The RULE.

Multiply one of the longest ides of it, by the Perpendicu- let fall from one of the Ob- se Angles to one of the long- Sides, and the Product will the Content.

19.5
10.2
390
195
19830

Let *ABC* be a Rhomboides iven, whose Sides *AB* or *CD* 19.5 Feet, and the Perpen- icular *AE* is 10.2, which ultiply together, the Product 198.9, that is 198 Superficial eet, and 9 tenth Parts the Con- nt. See the *Plate*, Fig. 1.

Demonstration.

If *BC* be extended to *F*, naking *CF* equal to *DE*, and Line be drawn from *B* to *F*, will the Triangle *CBE* be qual to the Triangle *ADE*, nd the Parallelogram *AEFB* e equal to the Rhomboides *ABCD*, which was to be pro- ed. *Plate* 1. *Fig.* 1.

To describe the *Rhomboides ABCD*, whose Angle at *G* hall be equal to the given An- le *HGI*, its longest Sides each qual to the given Line *KK*, nd its shortest each equal to he Line *LM*.

First, Make *CD* equal to *KK*, and make the Angle *C* equal to the Angle *HGI*, and make *CA* equal *LM*.

Secondly, On *A* with a Radius *CD* describe the Arch *EE*, and on *D* with a Radius *CA*, describe the Arch *FF*, intersecting the Arch in *EE* in *B*.

Thirdly, Join *AB* and *BD*, and the *Rhomboides* is compleated as required. *Plate* 1. *Fig.* 2.

RHOMBUS [in *Geometry*] is an obliquangular Parallelogram, or a quadrilateral Figure whose Sides are equal and parallel, but the Angles unequal, two of the opposite ones being Obtuse, and the other two Acute. Or,

RHOMBUS is a Figure representing a Quarry of Glass, having four equal Sides, the opposites of which are equal, two of its Angles being Obtuse and two Acute.

To find the Superficial Content.
The RULE.

Multiply one of the Sides by a Perpendicular let fall from one of the obtuse Angles to the opposite Side, and the Product is the Content.

Perpend.	13.42
The Side	15.5
	6710
	6710
	1342
Product	208.010

Let *ABCD* be a Rhombus given, whose Sides are each 15.5 Feet, and the Perpendicular *EC* is 13.42, which multiply'd toge-

together, the Product will be 208.010; which is the Superficial Content of the *Rhombus*.

By Scale and Compasses.

Extend the Compasses from 13.42, that Extent will reach from 15,5 the same way to 208 Feet, the Content.

Demonstration.

Let *CB* be extended out to *F*, making *DF* equal to *GD* and draw the Line *BF*; so shall the Triangle *DBF* be equal to the Angle *ACE*: For *DF* and *CE* are equal, and *BF* is equal to *AE*, because *AB* and *CF* are parallel; therefore the Parallelogram *ABEF* is equal to the Rhombus *ABCD*. See *Plate* 1. *Fig.* 2.

To delineate a Rhombus, *whose Sides shall be equal to a given Line* A B.

Make *DC* equal to *AB*, then on *C* with the Radius *DC*, describe the Arch *DEF*, and make *DE* and *EF* equal to *DC*.

2. Join *DE*, *EF*, and *FC* and the Rhombus is compleated as requir'd.

Note. That as the Angles of this Figure are all oblique, *viz.* the Angles *LH* acute, and *KI* obtuse, therefore their Diagonals *LH* and *KI* are unequal, *viz.* *LH* is longer than *KI*, notwithstanding that the Sides are all equal as in the Geometrical Square. Therefore if a Geometrical Square hath any two of its opposite Sides put out of a perpendicular Position, so as to alter their Right Angles, it instantly becomes a Rhombus or Diamond Form.

RIDES, Hinges for Doors.

RIDGE [in *Building*] the highest Part of the Roof or Covering of a House.

RIDGE *Tiles*, See *Tiles*.

RIGATE *Stones*, See *Fire Stones*.

RIGHT [in *Geometry*] Something that lies evenly, and without inclining or bending the one way or the other.

RIGHT *Angle*, is that form'd by two Lines, falling perpendicularly one on another.

RIGHT *Angled*, is understood of a Figure, when its Sides are at Right-angles, or stand perpendicularly one upon another.

ROD, a Measure of Length, containing by Statute sixteen Foot and a half *English*.

ROLLERS } [with *Carpenters*, *Masons*, &c.] are plain Cylinders
ROLLS }

of Wood, seven or eight Inches in Diameter, and three or four Foot in Length, us'd for the removing of Beams, huge Stones, or other like Burthens; which are cumbersome, but not exceeding heavy.

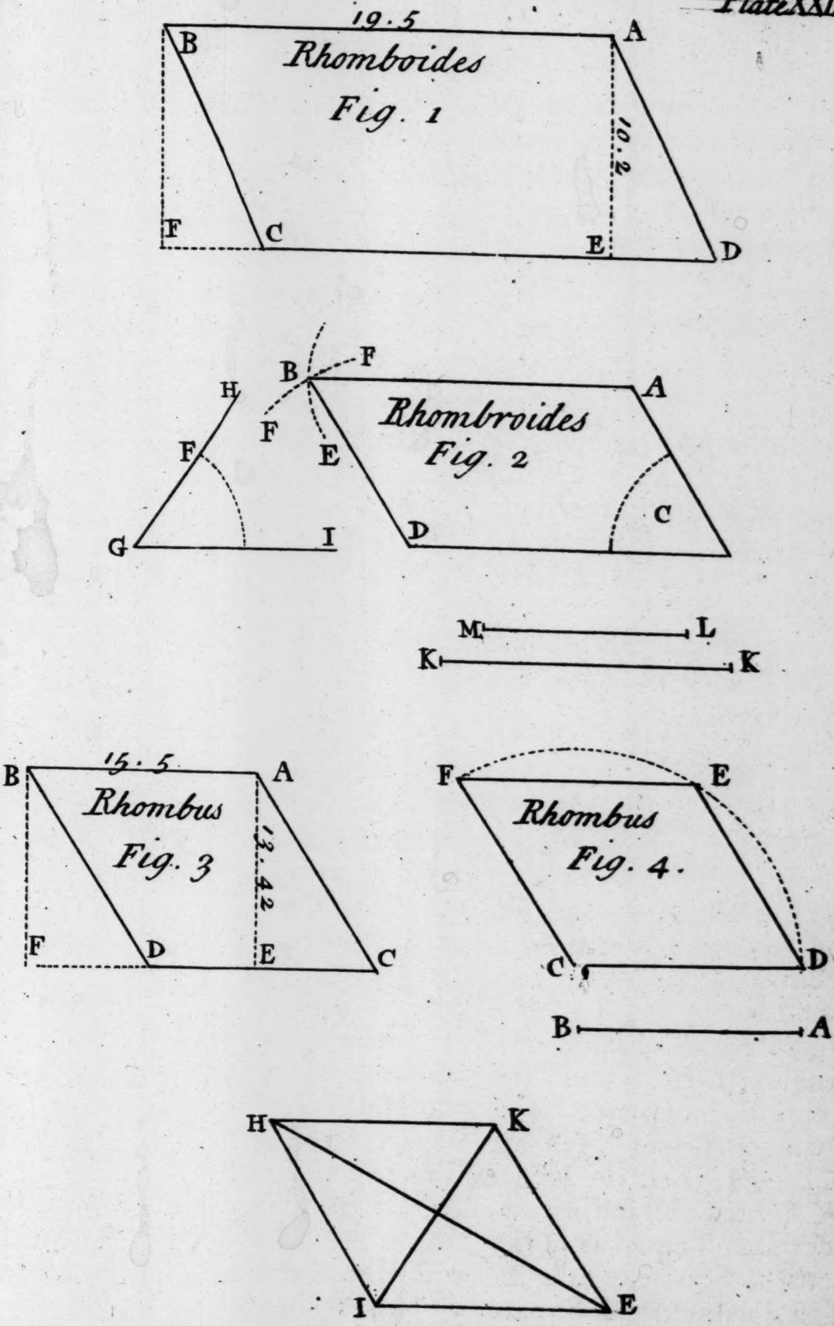
These *Rollers* are plac'd successively under the fore-part of the Massives or heavy Bodies to be remov'd; which at the same Time are push'd forward by Levers *&c.* apply'd behind.

Endless Rollers are us'd when they are to remove Blocks of Marble, or other excessive heavy Loads.

To give these the greater Force, and prevent their Bursting they are made of Wood jointed together by cross Quarters, being about twice the Length of

com-


B
F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B
A
Rhomboides
Fig. 1
10.2
F
C
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Fig. 2
F
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I
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L
K
K
15.5
B
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Rhombus
Fig. 3
13.42
F
D
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C
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E
Rhombus
Fig. 4.
C
D
B
A
H
K
I
E

mon *Rollers*, and girt with
ral large Iron Hoops at each
d.

At about a Foot Distance
n the Ends are four Mor-
es, or rather but two; but
rced through and through;
which the Ends of long
vers are put, which the
rkmen draw by Ropes fa-
'd to the End; still chang-
the Mortoise, as the Roller
made the quarter of the
rn.

ROLLING [in *Mechanicks*]
Revolving, is a Kind of
cular Motion, wherein the
veable turns round its own
is or Centre, and continually
lies new Parts of its Sur-
to the Body it moves upon.

The Motion of *Rolling* is op-
d to that of *Sliding*, in
ch the same Surface is con-
ally apply'd to the Plane it
es along.

The Friction of a Body in
ling, or the Resistance made
by the Roughness of the
e it moves on, is found to
much less than the Friction
liding,

Hence is the great Use of
eels, *Rollers*, &c. in Ma-
es as much of the Action
possible, being laid thereon
ake the Resistance the less.

ROMAN *Order* [in *Archi-
re*] is the same with the
posite. It was invented by
Romans in the Time of
ustus, and set above all o-
s, to shew that the *Romans*
Lords over other Nations;
made up of the *Ionic* and
nthian Orders.

ROOF [in *Architecture*] is the uppermost Part of a Building.

The Roof contains the Timber Work and its Covering of Slate or Tile, or whatsoever serves it as a Cover, tho' Carpenters usually restrain *Roof* to the Timber Work only.

The Form of *Roofs* are various, sometimes pointed; in which Case, the most beautiful Proportion is, to have its Profile an equilateral Triangle.

A *Square* ROOF, is that where the Angle of a Roof is a Right Angle, which therefore is a mean Proportional between the *Pointed* and

Flat ROOF, which is in the same Proportion as a Triangular Pediment. This is chiefly us'd in *Italy* and the hot Countries where little Snow falls.

Sometimes *Roofs* are made in the Pinnacle Form.

Roofs have sometimes a *double Ridge*, and sometimes *mutilated*, *i. e.* they consist of a *true* and a *false Roof*, which is laid over the former.

This last is particularly called a *Mansard*, from M. *Mansard*, a famous *French* Architect, the Inventor; sometimes they are in the Form of a *Plat-Form*, as most of the Eastern Buildings are.

Truncated ROOF is one, which instead of terminating in a Ridge or Angle, is cut square off at a certain Height, and cover'd with a Terrass, and sometimes encompass'd with a Ballustrade.

Sometimes a *Roof* is made in the Manner of a *Dome*, that is, having its Plan square, and the Contour circular.

Round

Round ROOF, is that where the Plan is round or oval, and the Profile a direct Descent.

Sometimes the Base being very large, is cut off to diminish its Height, and is cover'd with a Terrass of Lead rais'd a little in the middle, with Sky-Lights from Space to Space, to give Light to some *Corridore*, or other intermediate Pieces, which without such an Expedient would be too dark.

When the Walls have been rais'd to their design'd Height, the Vaults made, the Joists laid, the Stairs, &c. brought up, then the Roof is to be raised, which embracing every Part of the Building, and with its Weight equally pressing upon the Walls, is as a Band to all the Work, and besides, defends the Inhabitants from Rain or Snow, the burning heat of the Sun; and the Moisture of the Night, adds no small Help to the Building, by casting off the Rain Water from the Walls, which altho' it seems at present to do but little Hurt, yet in the Process of Time, is the Cause of much Damage.

Vitruvius tells us, the first Men built their Houses with flat Roofs, but finding that these did not defend them from the Weather, they (being constrain'd by Necessity) begun to make them ridg'd; that is to say, rais'd in the middle.

These Roofs are to be rais'd to a higher or lower Pitch, according to the Country in which they are.

For which Reason in *Germany*, they raise their Roofs to a very great Pitch, by Reason of the great Quantity of Snow that falls there.

They cover their Roof with *Shingles*, (*i. e.* small Pieces of Wood, or with thin Slates or Tiles; for if they would raise them otherwise, they would be ruin'd, by Reason of the Weight of the Snow.

But we who dwell in a more temperate Climate, ought to chuse such a Pitch as may secure the Building, and be of handsome Form.

Therefore we commonly divide the Breadth of the Roof into four equal Parts, and take three of them for the Roof which according to some make the most agreeable Pitch for our Country, and is the Foundation for raising any Manner of Roof, whether Square or Bevel.

As to ROOFS, says a modern Author, there is a Plate to go round a Building, which either may or may not be accounted a Part of the Roof, it may be esteemed as the Foundation or Tye of the Walls, or it may be taken as only that on which the Roof lies.

These Plates are to be Dove-tail'd at the Angles, and tenented together at their Length, which is what the Workmen call cogging down to the Plate, which prevents its flying out from the Foot of the Angle of a Building; Pieces Dove-tail'd cross the Angles of the Plate, serve to keep it from spreading, and is the Foot of the Hip.

There are various Sorts of Roof

Roofs, and various Ways of Framing them, and different Heights for Buildings of the same Breadth, according to the different Sentiments of Surveyors or Carpenters. And a good Roof is the most difficult and most useful Part of Carpenters Work.

The common Pitch of Roofs is to have the Rafters Length, if it spann'd the Building at once, to be three fourths of the Breadth of the Building.

Some make them flatter, as a Pediment Pitch, and the old *Gothick* Way, was to make them the whole Breadth; but some Authors take the middle Path between both Extremes of three fourths of the Breadth of the Building, and Pediment Pitch, making the Pitch or Perpendicular Height to be two sevenths of the Breadth of the Building, within Side; and the Length of the Rafter four sevenths, being of the Breadth of the Building, or twice the Perpendicular Height of the King Post.

Indeed *Palladio* says, the Breadth of the Place to be roofed, must be divided into nine Parts, two of which shall be the Pitch; for, says he, if the Roof were made one fourth of the Breadth, it would be too steep.

But it is to be observ'd, that *Palladio* speaks of *Italy*, or of Southern Climates, for he says in *Germany* where the Snow falls in great Quantities, the Roofs are made very sharp, and are cover'd with Shingles, *&c.* for otherwise the Weight of the Snow would crush them.

The Height of the Pitch of a Pediment, is one fourth of the Breadth of a Building, which is esteemed in *England* rather too flat, especially for Tileing: therefore some make Use neither of that Proportion, nor of the third of the Breadth of the common Pitch, and use a Medium Proportion between the two Extremes, *&c.*

Example. Suppose a Building to be ten Foot broad Work, according to the following Table.

If the Breadth of the Building be	The Pediment Pitch $\frac{1}{4}$ perpendicular Height.		The common one, $\frac{1}{3}$ perpendicular Height.		The Medium $\frac{2}{7}$ perpendicular Heights.	
Feet.	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.
10	2	6	3	4	2	$10\frac{1}{4}$
12	3	0	4	0	3	6
14	3	6	4	8	4	0
16	4	0	5	4	4	$6\frac{1}{2}$
18	4	6	6	0	5	2
20	5	0	6	8	5	$8\frac{1}{2}$
22	5	6	7	4	6	$3\frac{1}{2}$
24	6	0	8	0	6	$10\frac{1}{4}$
26	6	6	8	8	7	5
28	7	0	9	4	8	0
30	7	6	10	0	8	7
32	8	0	10	8	9	2
34	8	6	11	4	9	8
36	9	0	12	0	10	$4\frac{1}{2}$
38	9	6	12	8	13	$10\frac{1}{2}$
40	10	0	13	4	11	5

The Uſe of the Table is, if the Span or Breadth of a Buliding is 26 Feet, the Perpendicular Height of a Roof, Pediment Pitch is ſix Feet, ſix Inches; if the common Pitch, eight Feet, eight Inches, the Medium of which is made to be ſeven Feet, 5 Inches, for the following Reaſons.

The common Pitch, is not only unpleaſing to the Eye, but is attended with this Inconvenience, if there be a Gutter round the Building, the Steepneſs of the Roof occaſions Rain to come with ſo ſudden a Velocity and Force into the Pipes, which are to convey the Water from the Gutters, that it fills the Gutters, and ſometimes to that Degree, that the Water runs under the Covering of the Roof, and very much endamages the Timber, *&c.* of the Building, and the ſteeper the Roof is, the longer the Rafters, and the greater Quantity of Timber muſt be us'd in the Roof, as well as the more Weight from the greater Quantity of Timber, and the weakening the principal Timbers by adding more to its own Weight.

And the Pediment Pitch is inconvenient in lying too flat for theſe Climates ſo frequently ſubject to Rain and heavy Snows, which laſt would vaſtly preſs and incommode a Building, and would lie much longer on the Roof; its Declivity being ſo ſmall; beſides in ſtrong Winds, attended with Rain, the Rain would drive under the Covering of Tiles or Slates, *&c.* and cauſe great Decay of the Timber.

In Order to avoid theſe inconveniencies, the Medium between the two Extremes ma[y] be taken, according to the following Tables, in which ſom[e] are made ſtronger than others that the Method may be mad[e] Uſe of, as Neceſſity require[s] and Time is allow'd to perform it in.

Take the following Rule fo[r] the Proportion of Beams, who[se] Bearing varieth.

If the Beam bear in the Clear	Feet.	The Scantling must be	Inches.		Inches.
	12		6	and	8
	16		$6\frac{1}{4}$	and	$8\frac{1}{2}$
	20		$6\frac{1}{2}$	and	9
	24		7	and	$9\frac{1}{2}$
	28		$7\frac{1}{2}$	and	$9\frac{1}{2}$
	32		8	and	10
	36		$8\frac{1}{2}$	and	$10\frac{1}{2}$
	40		$8\frac{1}{2}$	and	11
	44		9	and	12

Of Roofs in General, obſer[ve] the following Examples.

Fig. 1. is an Hexagon Pla[n] and an *o g* Rafter.

Firſt, Draw the Plan *a b d e f*, alſo the Line *b h*, the middle *a b* at *i*, and draw th[e] Line *i h*; then will *b h* be th[e] Baſe of the Hip, and *i h* t[he] Baſe of the Rafter; from draw a Line to *k*, perpendic[u]lar to *i h*, and equal in Leng[th] to the Perpendicular of t[he] Rafter; alſo from *h* draw Line to *g*, Perpendicular to *b* and equal to *h k*; then dra[w] the Moulding Part of the Ra[f]ter *i k*, in what Form you thi[nk] prope[r]

per; so done, divide the e *i h* any how, from which isions raise perpendicular es to touch the Curve Line continue thole Lines to h the Line *b h*, as the ed Lines in the Example w, which will divide the e *b h*, into the same Num- of Parts and Proportion the Line *i h*; then from e Divisions raise perpendi- r Lines at Pleasure, and the perpendicular Line 1 on the Line *i h*, to the ve of the Rafter *i k*, in Compasses, and set it up correspondent perpendicu- Line, on the Line *b h*, as 1, also the Line 2.2, and 3, and so of all the rest; in each of those Points, a Nail, and bend a thin round them, to touch all at once; then on the of it, draw the Curve of Hip *g b*, which was to be

2, represents the Hip n Fig. 1. and 1 2 3 4 at oint *e*, represents the Sole Foot of the Hip, before ck is work'd.

t, Draw Lines on the at any convenient Di- parallel to the Foot e *a c*, Fig. 2. then draw ole of the Foot of the s 1 2 3 4 at the Point *e*, 1, and take in your sses the Distance between int 1, to the Line *e f*; 2, to the Line *e d*; and from the Back of the on those parallel Lines ll.

as you see mark'd by Dots on them; then strike a Nail into each of those Dots or Points, and bend a thin Lath, to touch them all at once, and on the Edge of it strike a Curve Line; then draw a middle Line, down the Back of the Hip, and between that Line and the Curves created by those Dots, hew off the superfluous Wood, which will make the true Back of the Hip, and so of all other Roofs, in what Form soever; but only observe if your Plan is bevel, as one End of Fig. 5, to set the Superfluity of the Sole of the Hip, at the Point *c*, which is from 3, to the Line *c b*; and from 4 to the Line *c d*, on their proper Sides of the Hip; because one Side will be wider than the other, which is the Case on the Back of all bevel Hips.

The Plan *a b c d e f*, in Fig. 3. is a Hexagon, the same as Fig. 1. and the Lines *b h*, *g h*, *h k* and *h i*, in the one is equal to *b h*, *i h*, *h g* and *h k*, in the other, so are the Soles of the Feet of the Hips 1 2 3 4, at the two Points *e*, and there is no other Difference than the Curves of the Rafters, and consequently needs no other Explanation; and so of the two Hips, Fig. 2. and Fig. 4. the two last Figures being laid down only for Variety Sake.

The Design of the Gable End or Roof B. Plate 2.

Let the whole Breadth of Gable End or Roof A A be 20 Foot; divide the same into

four equal Parts, take three thereof for the Length of the principal Rafter A B, and placing that Perpendicular from the Point C to the Point D, begets the Length of the Sleeper A D which will be 18 Foot. And the Length of the Dormer's principal Rafter from A to E, when laid to its Pitch upon the Back of the Principals, will reach to the Level Line F B or Top of the principal Rafter; and this is a general Rule for all Breadths.

1. Summer or Beam.
2. King-Piece, Crown Post, or Joggle Piece.
3. Braces or Strutts.
4. Principal Rafters.
5. The Sleeper.
6. Purlin of the Dormer.
7. Principal Rafter of the Dormer.
8. Single Rafter of the Dormer, standing on the Sleeper and Purlin.
9. The Point of the Sleeper.
10, 11. The Thickness of the Wall and Lintels or Wall Plates.

Of flat Roofs. Plate 3.

Within a Chamber Beam and Rafters joggled in, whose Weight lieth not chiefly in the middle, and may be so made, that without hanging up the Beam, the Principals may discharge the Weight, and how Drips may be made to walk on.

A Draught of a Flat Roof with a Crown or King Post.

The Breadth of the House, *Cantalivers*, *Cornices* and *Eaves*, the Length of the Rafti
and Curvings, which ought
be ⅜ of the Breadth House.

The Principal Rafters are
be cut with a Knee (as in t
Design) that they may the b
ter support themselves, and t
Burthen over them; upon t
Upright of the Wall, and a
secure that Part from the dr
ping in of the Rain, whi
otherwise would happen if t
Rafters were made plain a
furred.

The Beam to the Roof
Girder to the Garret Flo
ought to project without
Work as far as the furring
shreading, which is the Proj
ture of the *Cornice*.

1. Chamber Beam.
2. Principals joggled into t Chamber Beam.
3. The Place where Principals are joggled in.
4. Puncheons or Braces.
5. Drips to walk on, may be made with the Current, that the Roof m be made the more Pitch, the Strengthening thereof; may be made higher or lo according to the Building Discretion of the Architect
6. Battlements.

This Manner of framing Roof will be useful, from to 30 Foot, or thereabouts

1. Ground Plate.
2. Girder or Binding, i duce or Bressummer.
3. Beam to the Roof, Girder to the Garret Floor
4. Principal Posts, and right Brick-wall.
5. Braces.
6. Quarters.

7. Interduces.
8. Prick-Post or Window-Posts.
9. Jaumbs or Door Posts.
10. King-Piece or Joggle-Piece.
11. Struts.
12. Cellar-beam, Strut-beam, Wind-beam or Top-beam.
13. Door-hand.
14. Principal Rafters.
15. Furrings or Shreadings.
16. Ends of the Lintels and Pieces.
17. Bedding Moulding of the Cornice, over the Windows and Space between.
18. Knees of the Principal Rafters, which are to be of one Piece.
19. Purline.

ROOF. How to find the Length of the Sleepers to a Dormer Roof.

a c is the Width or Spand of the Roof, and *a b* and *c b*, is the Pitch of the Rafters; *i g* and *k d*, shews the Back of the Roof on which the Sleepers are to lie, and are equal to *a b* and *c b*, and *a c* is the Plate or Beam, on which the Rafters *a b c b* stand.

First, Draw the Gable End Rafters *a b* and *c b*, and divide them in the middle at *c* and *e*; from whence raise a Perpendicular at Pleasure, towards *f*.

Then take the Length of the Rafter in your Compasses, and set it on the Perpendicular at from *e* to *f*; and draw *f i* and *f d*, which are the Length of the Sleepers sought for.

The Names of the Timbers.

I. Beams. II. Principal Rafters. III. Cellar Beams IV. King Posts. V. Prick-Posts. VI. Struts. VII. Sleepers. VIII. Purlings. IX. Small Rafters.

ROOFING in ordinary Buildings is worth 7 or 8 *s. per* Square; but in great Buildings 10 or 11 *s. per* Square. See *Framing*.

Roofing is commonly measured by the Square, as Flooring.

ROSE [in *Architecture*, &c.] is an Ornament cut in the Resemblance of a Rose.

It is chiefly us'd in Friezes, Cornices, Vaults of Churches, and particularly in the middle of each Face of the *Corinthian* Abacus. And in the Spaces between the Modillions under the Plafonds of Cornices.

ROSE-NAILS. See *Nails*.

ROTATION [in *Geometry*] is the Circumvolution of a Surface, round an immoveable Line, call'd the Axis of Rotation.

ROTATION [in *Mechanicks*] Rolling, or turning round.

ROTHER NAILS. See *Nails*.

ROUGH STONE. See *Rag-Stone*.

ROUGH CASTING. See *Plaistering*.

ROUGH *Mortar* is us'd in many Places in *Kent*, &c. and is made with a Sort of Sand, which when it is mix'd with the *Lime*, makes it look as red as Blood, but with these they mix Powder of Cinders, which changes

changes it to a kind of blueiſh Colour, with this they rough caſt their Houſes.

ROUND HEADS. See *Nails*.

RUDENTURE [in *Architecture*] is the Figure of a Rope or Staff ſometimes plain, ſometimes cut carved, with which the third Part of the Flutings of Columus, are ſometimes fill'd up.

There are alſo *Rudentures* in *Relievo*, laid on the naked of Pilaſters, not Fluted, an Inſtance of which we have in the Church of St. *Sapienzia*, at *Rome*.

RUDENTURES ſays M. *Le Clerc*, are cut, on ſome Occaſions in the Flutings, to ſtrengthen their Sides, and render them leſs liable to be broken.

For Inſtance, when Fluted Columns or Pilaſters are made without Pedeſtals, and plac'd on a Level with the Ground; or at leaſt ſo little rais'd, as to be without the reach of the Hand; their Flutings muſt be rudented or cabled (as they call it) as far as one third of their Height; that is, they muſt be fill'd up one third Part to that Height with theſe Rudentures, in Order to ſtrengthen the Sides, which might otherwiſe be ſoon defac'd.

Theſe Rudentures, which were at firſt invented for Uſe, ſays M. *Le Clerc*, have been ſince converted into Ornaments to enrich the Flutings, ſo that inſtead of plain ſubſtantial Rudentures, we now frequently ſee them exceedingly weak and ſlender, being wrought in Form of twiſted Ribbons, Foliage, Chaplets, and other rich and delicare Ornaments.

But this kind of Rudenture, ſays he, ſhould never be us'd except in Columns and Pilaſters of Marble, and ſuch as are beyond the reach of the Hands of the People.

One may likewiſe for the greater richneſs, as well as for the Sake of the greater Eaſe, make theſe Ornaments of Braſs gilt, to be fitted wichin the Flutings.

Theſe delicate Ornaments are alſo found to ſucceed very well in Columns and Pilaſters of Wood; where they are cut with a great Deal of Eaſe and Juſtneſs.

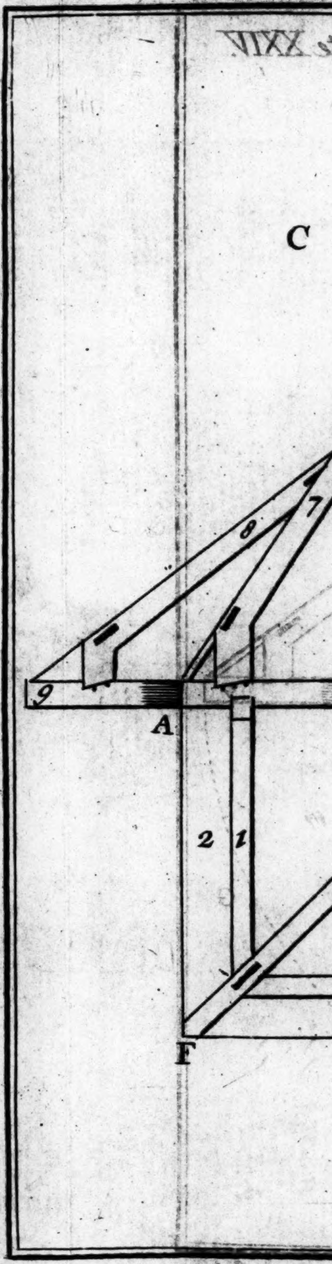
RUDERATION [in *Building*] is a Term us'd by *Vitruvius* for the laying of a Pavement with Pebbles.

To perform the *Ruderation*, it is neceſſary that the Ground be well beaten to make it firm and to prevent it from cracking. Then a *Stratum* of little Stones are laid to be afterwards bound together with Mortar made of Lime and Sand.

If the Sand be new, its Proportion may be to the Lime as 3 to 1, if dug out of old Pavements or Walls, as 5 to 2.

RUDERATION as *Daviler* obſerves, is us'd by *Vitruvius* for the courſeſt and moſt artleſs kind of Maſonry, where a Wall is, as it were, cobbled up.

RULE, a ſimple Inſtrument, ordinarily of hard Wood, thin, narrow and ſtrait, ſerving to draw Lines withal.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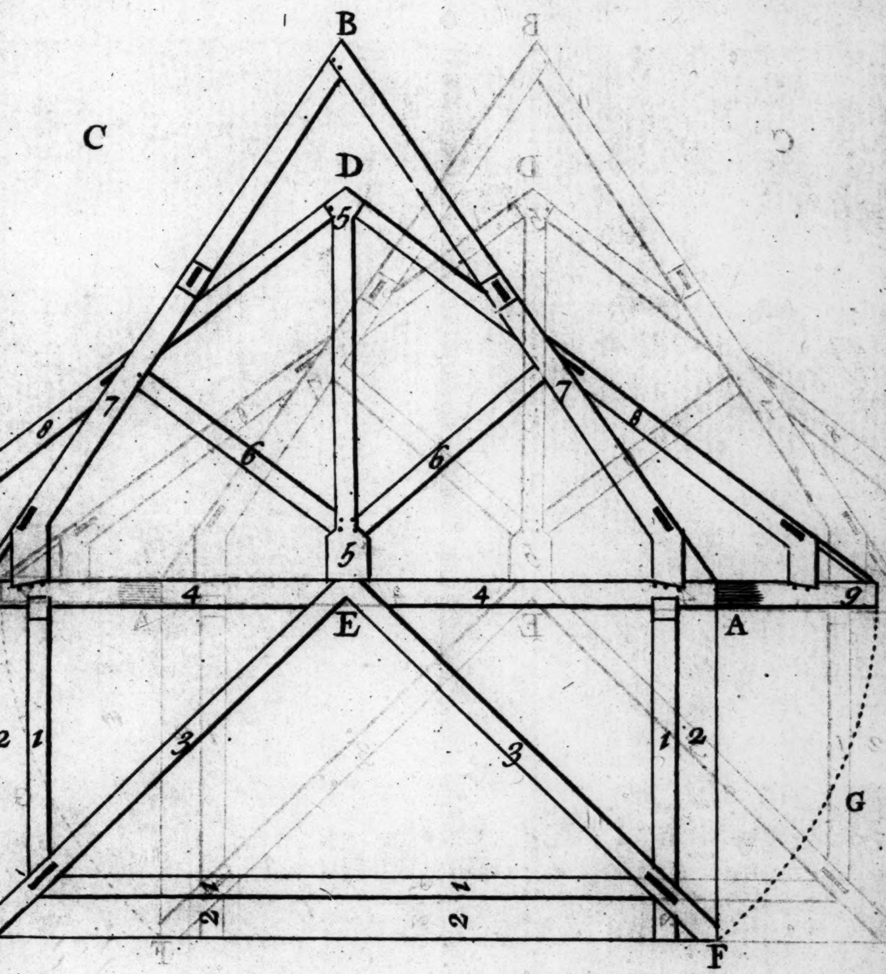
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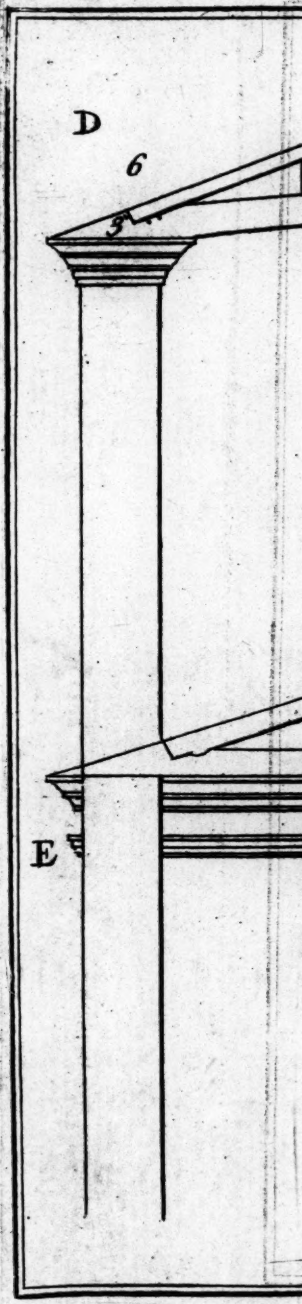
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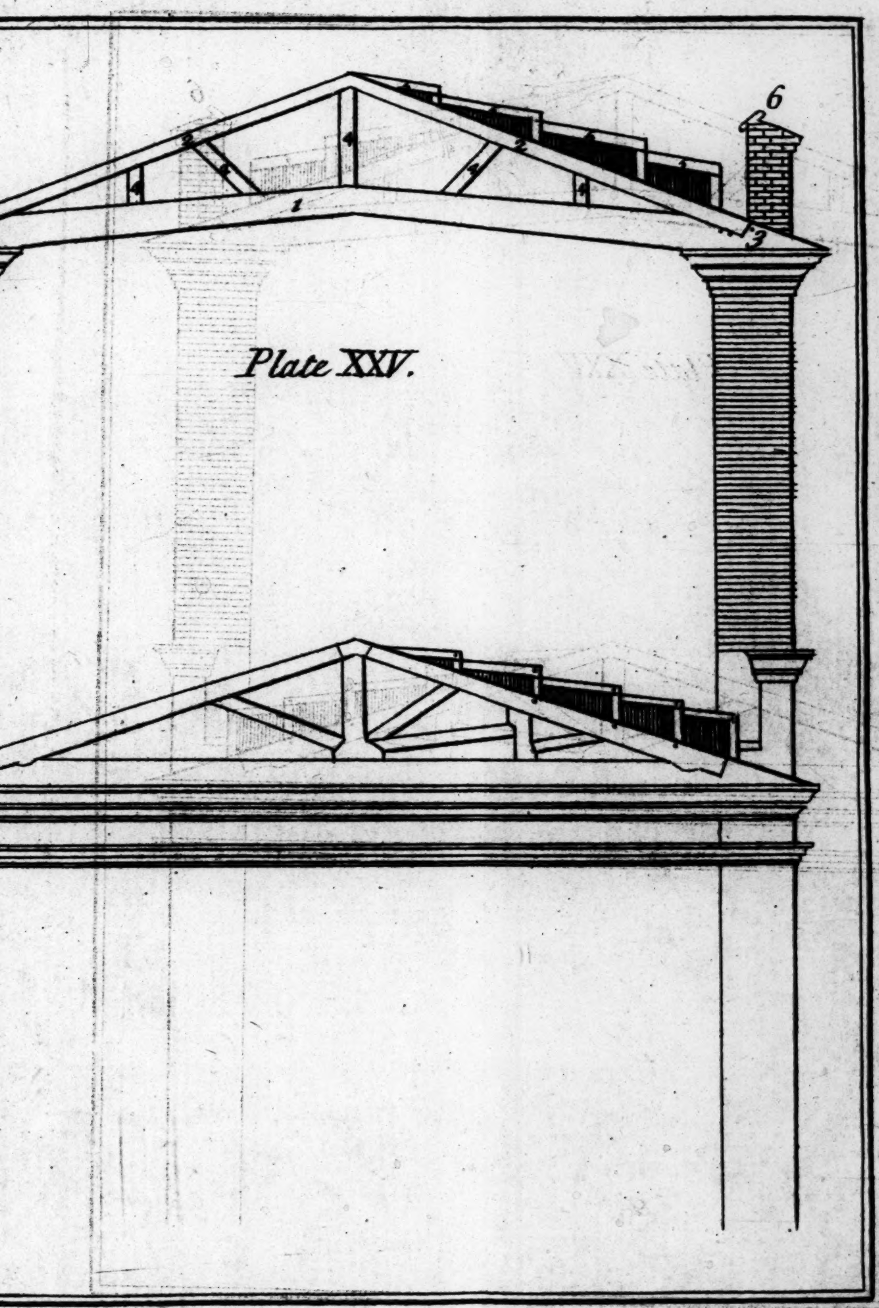


Plate XXV.

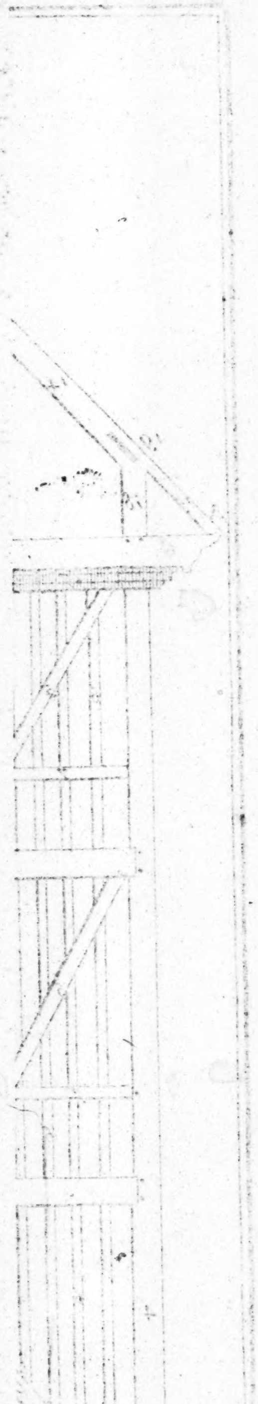


Plate XXVI.

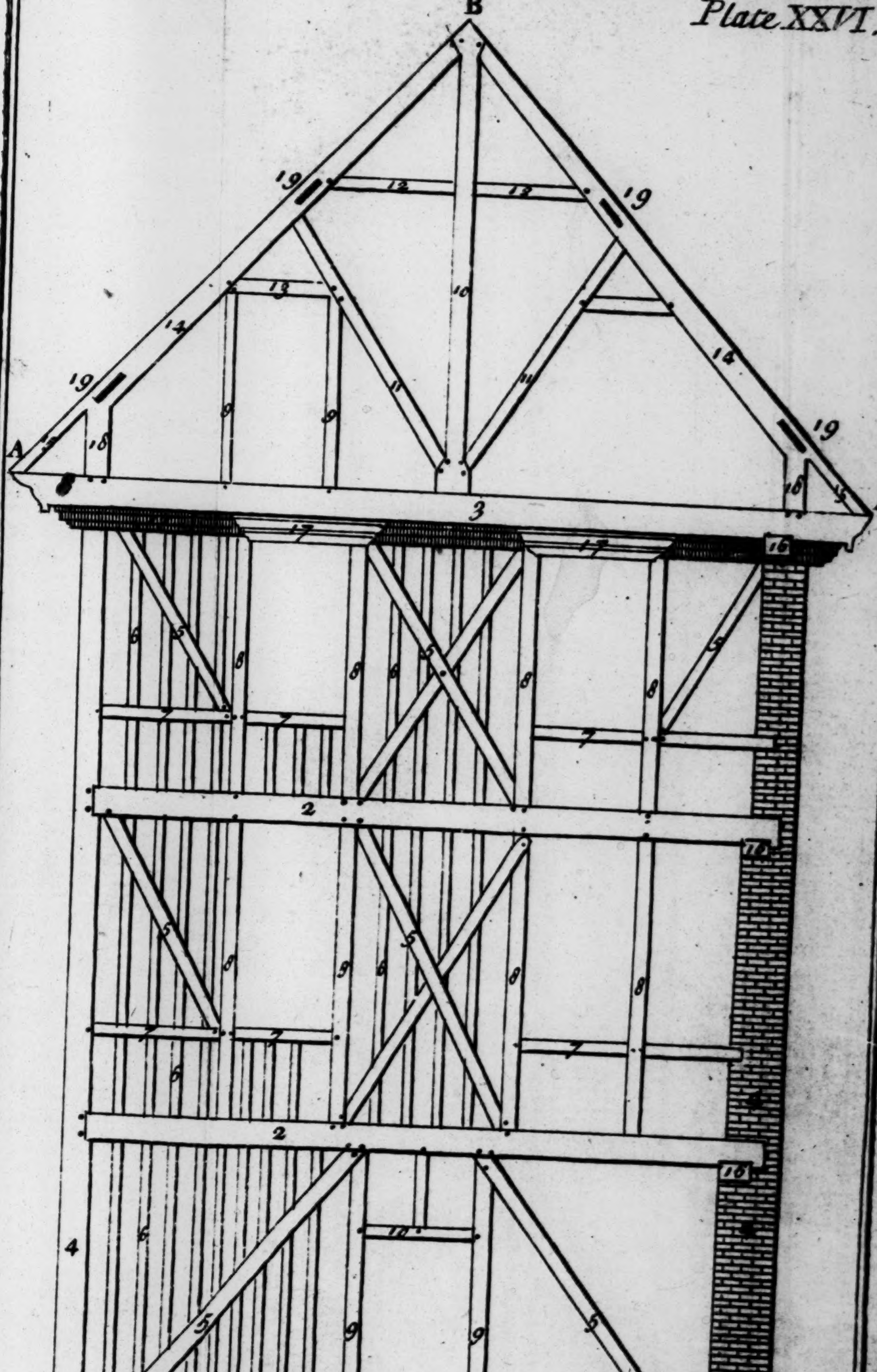
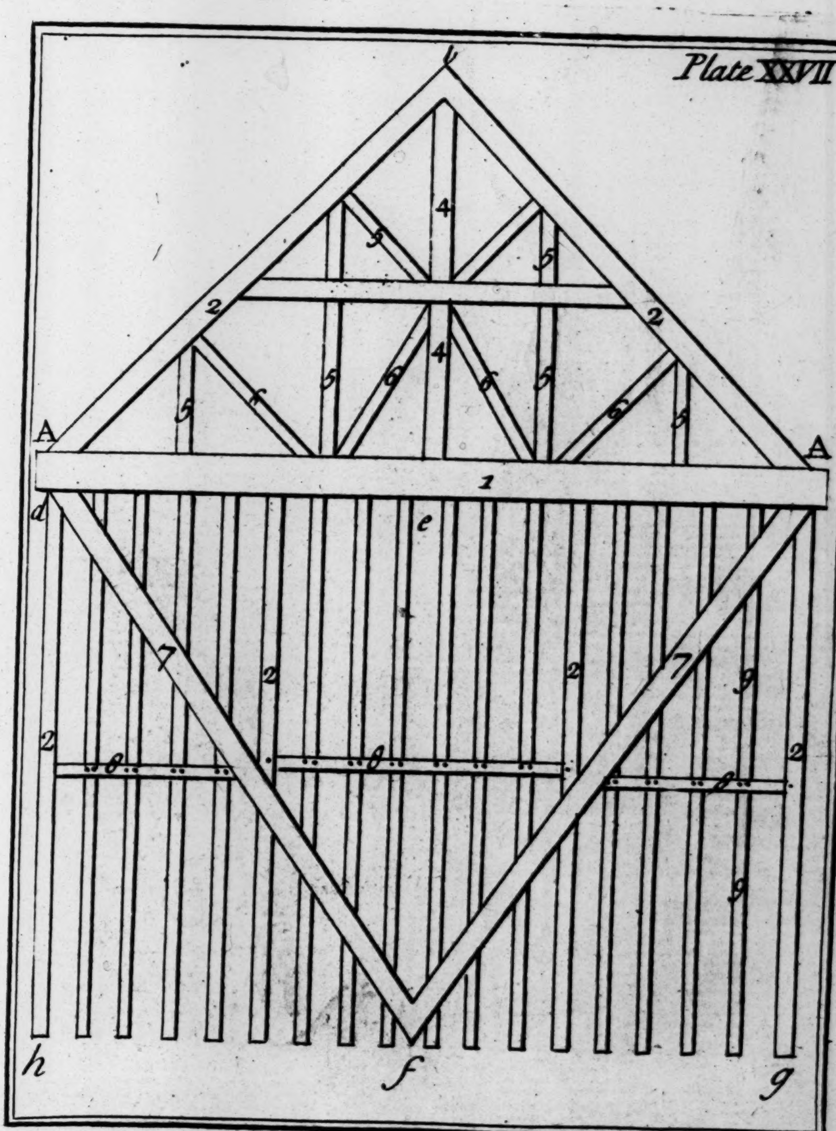


Plate XXVII



A Masons Rule is 12 or 15 Foot long, and is apply'd under the Level for regulating the Courses, and for making the Piedroits equal.

A Stone-Cutters Rule is ordinarily four Foot long, and divided into Feet and Inches.

Carpenters Rule is an Instrument most commonly made of Box Wood, 24 Inches long and one and a half broad; each Inch being subdivided into 8 Parts. On the same Side with these Divisions, is usually *Gunter's Line* of Numbers.

On the other Side are the Lines of Timber and Board Measure, the first beginning at 8½, and continued to 36, near the other End: The latter is numbred from 7 to 36 4 Inches from the other End.

The Use of Coggleshal's *Sliding* Rule *in the Mensuration of Artificers Work.*

This is generally plac'd upon one Side of one Leg of a two Foot Rule, consisting of four Lines.

Of which two Lines are plac'd on a Slip or sliding Part, and the other two upon the Leg of the Rule, and are thereby fix'd.

These last two Lines plac'd on the Rule, shall be hereafter in Practice call'd the *Stock*, and the two middle Lines, the *Slip*.

2. The uppermost Line on the Stock, and the two Lines on the Slip are all alike numbred, viz. from 1, 2, 3, &c. to 1 in the middle, and from thence to 10 at the End, and the undermost Line from 4, 5, 6, &c. to 40, which is the Square Line, and when us'd in Timber, the Girt-line.

3. Take Notice also, that the Lines on the Slip, and that next above it, are each divided between 1 and 2 into 10 Parts, and each tenth is subdivided into 5 Parts, and consequently the whole Division contain'd between 1 and 2, is thereby divided into 50 Parts, and if each Division be suppos'd to be again subdivided or equal to 2; then the whole Space may be said to be divided into 100 Parts.

4. The Spaces between 2 and 3, and between 3 and 4 are each decimally divided into 10 Parts, as before; and as the Distance between 2 and 3 is less than between 1 and 2, therefore these tenths are each subdivided into two Parts, and consequently the whole Space between 2 and 3, will be divided but into 20 Parts; and if each Part be accounted to be divided into five lesser Parts, or each = 5, then the whole Space between 2 and 3, may be or suppos'd to be divided into 100 Parts, as before between 1 and 2.

5 The other Divisions between 4 and 5; 5 and 6; 6 and 7; 7 and 8; 8 and 9, being yet lesser and lesser, are therefore divided into 10 Parts only; wherefore accounting each Part equal to 10, then every of these Divisions may be suppos'd to be divided into

100 Parts, as the Preceeding.

6. The remaining Length from 1 inthe middle, to 10 at the End. is divided reſpectively after the ſame Manner, as alſo are the reſpective Diviſions of the Girt Line on the Stock, which are contain'd between the beginning of it at 4 to 10; but the Diviſions from 10 to 40, are firſt each decimally divided into tenths, and each tenth ſubdivided into 4th Parts.

At the Girt Line, juſt at the Beginning before 4, there are two Diviſions, each ſubdivided into four Parts; and at the End beyond 40, there are two, each ſubdivided into two Parts.

Theſe two Diviſions at the End of the Line beyond 40, each ſubdivided into two Parts, are the ſame as the firſt two Diviſions divided into halves, that are next after 4 at the beginning of the Line, that is, if you ſuppoſe that from 40 the whole Line was immediately to begin again, placing 4 the Beginning in the Place of 40 at the End, then thoſe two Diviſions would repreſent the firſt two Diviſions between 4 and 5.

Likewiſe the two Diviſions ſub divided into four Parts, plac'd before 4 at the Begining are equal to the two laſt Diviſions, next before 40, at the End.

That is, ſuppoſing that the Space between 30 and 40 at the End of the Line was to be prefix'd before 4 in the beginning, then would the two laſt Diviſions before 40, be in the ſame Place of the two Diviſions before 4.

To number or expreſs Quantities, on this Rule obſerve

1. Let the Space between 1 at the beginning of the Line, and 1 in the middle, repreſent one Integer, as one Foot or one Inch, &c. then will 1 at the beginning, ſignify $\frac{1}{10}$ thereof; 2 will ſignify $\frac{2}{10}$; 3 will ſignify $\frac{3}{10}$, and ſo on; and laſtly the 1 in the middle 1 Integer as aforeſaid; and as before was ſhewn, that every ſuch principal Diviſion of 1, 2, 3, 4, 5, 6, 7, 8, 9; 1 was ſeverally divided into 100 Parts, therefore this Integer is divided into 1000 Parts.

2. The following Diviſions from 1 in the middle, as 2, 3, 4, 5, 6, 7, 8, 9, 10, are ſeverally whole Integers; that is when the Space from 1, in the beginning to 1 in the middle, is reckon'd the Integer, then the 2 following, ſignifies two Integers; the 3, ſignifies three Integers, &c. and ſo conſequently the End of the Line, ſignifies ten Integers, and their reſpective ſub-diviſions, repreſent their fractional Parts, as have been before ſhewn in the firſt Integers.

3. But if 1 at the beginning of the Line be accounted an Integer or one, then the 2 following ſignifie two Integers, the 3 following, three Integers, &c. and the 1 in the middle ſignifies 10 Integers.

Now as the two following the 1 in the middle, did before repreſent

present 2, when the 1 in the iddle represented one Integer, now will the same 2 reprent 20, when the 1 in the mide represents ten Integers, and nsequently the following numrs, 3, 4, 5, &c, to 10, will present so many hundred Ingers to 1000; so in like Mant, if the Line be began with o, then the 1 in the middle ill represent 1000, and the at the End, 10000, &c.

4. When the Line is begun ith 1, and the middle one sigfies 10, then every Decimal tenth Division following beveen 1 and 2, between 2 and , &c. will represent an Inter.

Thus the first tenth Division fter 1, in the middle signifies 1, the second tenth, 12; which number'd 12 with a smaller igure than the others, and ometimes only distinguish'd y four Points thus : : and like Manner of all others, of hich every fifth is distinuish'd by a longer Stroke than e others, as 15, 25, 35, &c. d the Subdivisions of each nteger, are fractional Parts hereof.

5. When the Line is begun ith 10, then every tenth Division between 1 and 2, beween 2 and 3, &c. does each epresent an Integer (as has een said before of the tenths llowing the middle of the ine) thus the first tenth after at the beginning, signifies 11, e second tenth, 12, the third nth, 13, &c. (which has its Division longer than the others, s aforesaid) the sixth tenth, 6, &c.

The Uses of this Rule in Measuring.

1. To multiply one Number by another.

The Analogy is,

As 1 is to the Multiplier : : so is the Multiplicand to the Product.

Example 1. Multiply 7 by 9.

Practice. Begin the Line 1, and set 1 on the Slip, to 7 the upper Line of the Stock, and against 9 on the Slip, stands 63 on the upper Line of the Stock, which is the Product requir'd.

Example 2. Multiply 10 by 12.

Practice. Begin the Line with 10; set 1 on the Slip to 10 on the Stock, and against 12 on the Slip, stands 120 on the Stock, which is the Product requir'd, and so in like Manner any other Number given.

To perform Division by Rule.

The Analogy is,

As the Divisor is to 1. : : so is the Dividend to the Quotient requir'd.

Practice. Divide 72 by 9. begin the Line with 1, place the Divisor 9 on the Stock against 1 on the Slip, and against 72 on the Stock, stands 8 on the Slip, which is the Quotient required.

Example 2. Divide 630 by 15. Begin the Line with 10, then against the Divisor 15 on the upper Line of the Stock set 1 on the Slip, and against 630 on the Stock, stands 42 on the Slip, which is the Quotient requi d.

The Rule of Three, *by the Sliding Rule.*

The Analogy is,

As the first given Number is to any other Number (as 5 is to 11, *&c.* so is the second given Number (as 10) to a fourth Number, which is the Number sought for in the same Proportion.

Example 1. If five Men are paid 11 Pounds for one Weeks Work, what must ten Men receive for the same Time, at the same Rate?

Practice. Begin the Line with 1, then set 5 on the Slip against 11 on the Stock, and against 10 on the Slip stands 22 on the Stock, which is the Answer of the Question.

Example 2. If the Diameter of a Circle be 7 Feet, whose Circumference is 22 Feet, what is the Circumference of another Circle, whose Diameter is 22 Feet?

Practice. Begin the Line with 1, then set 7 on the Slip, against 22 on the Stock, and against 21 on the Slip, stands 66, the Circumference requir'd.

Example 3. If 21 Bric pave one Yard square, ho many Bricks will pave 30 Yard

The Analogy is as 1 is to 2 so is 30 to the Number requir'

Practice. Set 1 on the Sl to 21 on the Stock, and again 30 on the Slip, stands 630 t Answer of the Question.

Now in working of the Ru of Three direct, as in the pr ceeding Examples, you se that as the second Number always greater than the firs the fourth Number will be a ways greater than the third and *e contra.*

And in the Rule of Thre Inverse, as in the following Ex ample; if the second be le than the first, the fourth w be less than the third; and *contra.*

Example 4. If the Circum ference of a Circle be 44 Fee what will the Diameter of an ther Circle be, whose Circum ference is 66 Feet?

The Analogy is as 44 to : : So is 66 to the Number r quir'd.

Practice. Begin the Li with 1, and against 44 on t Stock, set 14 on the Slip, th against 66 on the Stock, stan 22 on the Slip, which is t Diameter required.

Now from these Exampl it is plain that the second a third Numbers are never tak on the same Line which is ways to be remembred.

It is alſo to be obſerv'd.

If in placing the firſt Number to the ſecond, the third falls beyond the Line, take the third Number in the firſt Part, or the other Length of the Line, as if it was continued; giving it its Value, according to its Place, as before ſhown.

Of the Extraction of the Square Root.

By the Help of the lowermoſt Line on the Stock, before call'd the *Square Line* or *Girt Line*, the Square Root of any Number not exceeding 10000, may be very readily found, as follows.

Practice. Begin the lowermoſt Slip of the Line with 10, and ſet 16 thereof to 4, the beginning of the Square Line, then the Numbers of the Square Line will be the Square Roots of the Numbers contain'd in the lower Line of the Slip; or thoſe Numbers in the Slip, will be the Squares of thoſe of the Girt Line on the Stock.

Thus againſt 5 on the Girt or Square Line, ſtands 25 on the Slip, and againſt 6 on the Girt, ſtands 36 on the Slip: So in like Manner.

$$\text{againſt}\left\{\begin{matrix}7\\8\\9\\10\\20\\30\end{matrix}\right\}\text{ſtands}\left\{\begin{matrix}49\\64\\81\\100\\400\\900\end{matrix}\right\}\begin{matrix}\text{which are the}\\\text{Square Num-}\\\text{bers of}\end{matrix}\left\{\begin{matrix}7\\8\\9\\10\\20\\30\end{matrix}\right\}$$

Hence 'tis plain that any given Square Number, under 1000 being found in the lower Line of the *Slip*, its *Square* Root or Side of its Square is that Number in the *Square* or *Girt-Line*, which is oppoſite to it.

2. Remove the Slip, and place its beginning 1 to 10 on the *Square* or *Girt-Line*, and accounting 1 the beginning of the Slip, as 100, then 40 on the *Square* or *Girt Line* ſtand againſt 1600 its Square in the *Slip*, and thus you have the Root of any Square Number under 1600.

3. Remove the Slip to its firſt Station, placing 16 on the Slip (beginning the Line with 10) againſt 4 the beginning of the *Square Line*; and then reckoning the ſaid 16 in the Slip to be 1600, and the 4 in the *Girt-Line* againſt it to be 40; as when thoſe Numbers were together at the other End in their laſt Station; then will the Square Numbers in the Slip go on from 1600 to 10000, whoſe Roots are contain'd in the Square Line oppoſite thereto: thus

Thus

Thus the Square Root of

Square		Root
1600		40
2500		50
3600		60
4900		70
6400	is	80
8100		90
10000		100
40000		200
90000		300&c.

as exhibited by the opposite Divisions in the *Square* or *Girt-Line*.

And removing the Slip as at the second Operation, you may continue the square Numbers to 160000; and then altering the Slip as at the third Operation, you may continue them from 160000 to 1000000, and so on in like Manner *ad infinitum*.

To measure the Dimensions of Mason's Work by the Sliding Rule.

The Analogy for Foot Measure is as follows.

As 12 on the upper Line on the Stock, which in Foot Measure is always fix'd, and therefore noted with small Figures, (as has been before noted) is to the Dimensions Length in Feet and Parts of Feet accounted on the Slip.

So is the Breadth in Inches accounted on the upper Line of the Stock.

To its Content in Feet on the Slip.

Example. A Piece of Marble Pavement is 36 Foot and half in Length, and 33 in Breadth, what is the Superficial Content?

Practice. Set the Length 36 Feet and a half on the Slip to 1, the upper Line of the Stock, and against 33 on the Stock, shall stand 100, $\frac{1}{3}$ the Content requir'd.

And here it is to be observ'd, that when Fractions happen, as in this Example, they ought to be estimated as near to the Truth as can be, which in Practice of Business is near enough for our Purpose.

But to determine the true Quantity or Value of Fractional Quantities (it being impossible to be done by this Rule) you must have recourse to Vulgar or Decimal Arithmetick.

Example 2. In a *Portland* Slab 8 Feet 3 Inches long, and $17\frac{1}{2}$ Inches broad, how many Feet does it contain?

Practice. Set the Length 8 Feet 3 Inches on the *Slip* (which is 8 and $2\frac{1}{2}$ of the Subdivision of the Tenths) to 12 on the upper Line of the *Stock*, and against $17\frac{1}{2}$ on the *Stock* stands 12 and a very little more, which is equal ro $4\frac{1}{2}$ square Inches, the true Content required.

And so in the like manner any other Quantities, as given.

The

The next in Order is solid Measure; which Business generally happens under the Forms of the Cylinder, the Cube, and the Parallelopipedon.

Of the *Cylinder*, the Analogy is as follows.

As the Length in Feet and Inches accounted in the lower Line of the Slip,

Is to 10, 635. accounted on the *Girt Line*;

So is ¼ of the Circumference or Girt in Inches,

To the solid Content in Feet required.

Example, In a Cylinder of Stone, 28 feet 9 inches long, and 15 Inches ¼ of its Girt or Circumference; what Number of solid Feet does it contain?

Practice. Set the Length 28 feet ¾ in the *Slip* to 10.635 in the *Girt Line*, and against 15 the Quarter of the Cylinder's Girt, accounted on the Girt Line, stands 61 on the *Slip*, which is the solid Content required.

Of the *Cube*, the Analogy is as follows.

As the Length or Side of the Cube in Feet and Inches accounted in the lower Line of the *Slip*,

Is to 12 accounted on the *Girt Line*,

So is the Depth or Side of the *Cube* in Inches, accounted in the *Girt Line*, to the solid Content in feet accounted on the *Slip*.

Example. There is a *Cube* of Stone, whose Side is 2½ feet; what is the solid Content of it?

Practice. Set the Side of the Cube 2½ feet, accounted on the *Slip*, to 12 on the *Girt Line*, and against 30 the Side of the Cube in Inches (which is equal to ¼ of its Girt) stands 15½.

Of the *Parallelopipedon* the Analogy is the same as before of the *Cube*.

As the Length of the *Parallelopipedon* taken in feet and inches, accounted on the lower Line of the *Slip*,

Is to 12, accounted on the *Girt Line*,

So is half of the Girt of the Parallelopipedon in Inches accounted on the *Girt Line*, to the solid Content in Feet accounted on the Slip.

Example. There is a long Cube or Parallelopipedon, whose Length is 17 feet 9 inches and ¼ Part of the Girt accounted on the *Girt Line*, and against 22½ inches the ¼ of the Girt accounted on the Girt Line stands 66 in the Slip, which is the solid Content requir'd.

But here it is to be remembred that, if the Base of the *Parallelopipedon* is not exactly square; having its Breadth greater or less than its Depth, then its Depth will, by taking ¼ of the Girt, not give the true Solidity.

But in such case you must find a mean Proportional between the Breadth and the Depth;

Depth; and this being done, you may then proceed as if the Breadth and Depth were equal.

A mean Proportional is a Number, which being squar'd or multiplied into it self, produces the same Quantity that two given Numbers would do, being multiply'd into one another, to which it is a mean Proportional; or otherwise it is the square Root of the Product produc'd by the Multiplication of the two unequal Sides into one another.

Suppose the Breadth of the Parallelopipedon be 9 inches, and the Depth 4 inches. I say, if the 9 be multiply'd by 4, the Product will be 36; and the mean Proportional between 4 and 9 is 6; for 6 times 6 is 36, which is equal to 4 times 9: Therefore 6 is the mean Proportional between 4 and 9.

Now suppose the Dimensions be as before, *viz.* 9 inches in Breadth, and 4 in Depth, and consequently is 26 inches in Girt; of which, if you take $\frac{1}{4}$ Part, *viz.* 6 $\frac{1}{2}$ for the Side of the Square, as in the Square Parallelopidedon, it is plain that it will produce a content too great for 6 $\frac{1}{2}$ multiply'd by 6 $\frac{1}{2}$ will produce 42 $\frac{1}{4}$, which is 6 $\frac{1}{2}$ too much in the Area, and that being multiply'd into the Length would carry on the Error much higher.

Hence it is evident, that to Measure an unequal Parallelopipedon, there must first be a mean Proportional found, which may be easier produced from the square Root of the Area of the Base, or as follows.

Set the greater of the 2 Numbers (as here 9) on the Square or *Girt-line* to the same Number 9 on the *Slip*, against the less Number 4 accounted on the *Slip*, stands the mean Proportional (6) on the square Line.

Or thus,

Set the less Number (4) on the same Number (4) on the square Line, and against the greater Number (9) accounted on the *Slip*, stands the mean Proportional (6) on the square Line as before.

The Mensuration of *Bricklayers* Work by this Rule.

Bricklayers Work is measured by the Foot, Yard, Square, and Rod.

In Yard Measure, the first stated Number must be 9, and for Rod Measure 272, which in Foot Measure is but 12, and in Order to these Operations it will be necessary to have a little Brass Stud fix'd in the upper Line of the *Stock* and *Slip* at 9, and 272 and $\frac{1}{4}$, whereby those Centre-points (as Workmen call them) or first Numbers will be readily found.

In *Yard Measure* you must take Notice that the Dimensions are taken in Feet and Quarters of Feet.

The Analogy in *Yard* Measure is,

As the fixt Number 9 accounted on the upper Line of the *Stock*.

s to the Breadth in Feet accounted on the *Slip*; so is the Length accounted on the *Stock*, the superficial Content on Slip.

Example 1. If a Cellar be pav'd with paving Bricks, the Length of which is 15 Feet $\frac{3}{4}$, the Breadth 12 and $\frac{1}{4}$, what ll be the superficial Content reof?

Practice. Set the Breadth Feet $\frac{1}{4}$ on the Slip to the fixt Number 9 on the *Stock*, and against 15 Foot $\frac{3}{4}$, accounted on the Stock stand 21 $\frac{1}{3}$ on the *Slip*, which is the superficial Content requir'd.

Example 2. If 30 Bricks pave Yard, how many Yards will 0 Bricks pave?

The Analogy.

As the Bricks of one Yard counted in the *Stock*.

Is to 1 accounted on the *Slip*.

So is the Number of Bricks ven, accounted on the *Stock* the Yards, which they will ve accounted on the Slip.

Practice. Set 30 on the Stock 1 on the Slip, and against 0 on the *Stock* stands 21 on *Slip*, which is the Number Yards that 630 Bricks will ve.

Of Square Measure.

In this the Dimensions are ken in Feet and Quarters of et as in Yard Measure.

By square Measure is meant a square Space, containing 100 square Feet, or it is a Geometrical Square, whose Side is equal to 10 Feet, and consequently the whole equal to 100 Feet.

By this Measure all Manner of Tileing and Slating is perform'd, as follows:

As the Breadth accounted on the *Stock*.

Is to 100 accounted on the *Slip*.

So is the Length accounted on the *Slip*, to the content accounted on the *Stock*.

Example. If a Roof be 70 Feet in Length, and 15 Feet in Depth from the Ridge to the Eaves, what is the Content of it.

Practice. Set the Breadth 15 accounted on the *Stock*, to 1 accounted on the *Slip*, and against the Length 70 on the *Slip*, stands 10 $\frac{1}{2}$ the Number of Squares therein contain'd, which is equal to 1050 square Feet.

This Product or Content is but $\frac{1}{2}$ the Quantity of Tileing if both Sides of the Roof are equal, therefore the 10 $\frac{1}{2}$ Squares being doubled, the Content of the whole will be found to be 21 Squares compleat.

And here it is to be noted, that as one Square is equal to 100 Feet.

Half a Square is equal to 50

A Quarter of a Square equal to 25

And half a Quarter of a Square equal to 12 $\frac{1}{2}$

Rod

Rod Measure.

Rod Meaſure is a ſquare Meaſure conſiſting of 272 ½ ſquare Feet, produced by the Squaſing of a Rod in Length, *viz.* 16 ½ Feet multiply'd into itſelf its product is 272 ¼, the odd ¼ is rejected, and the 272 Feet only is reckoned a ſquare Rod.

By this Meaſure are meaſured all Manner of Walls and Chimneys, which, tho' of various thickneſſes, yet they are all meaſured as ſuperficial Meaſure, being reduced to the Standard thickneſs of one Brick and Half.

By this Analogy.

As the Length accounted on the *Stock.*

Is to 272 accounted on the *Slip.*

So is the Height accounted on the *Slip* to the Content on the *Stock.*

Or thus,

As the fixt Number 272 on the Slip.

Is to the Length accounted on the Stock.

So is the Height accounted on the Slip to the Content on the Stock.

Glazier's Work.

Glaziers Meaſure their Work by the Foot Square, and take their Dimenſions in Feet and 100 Parts of a Foot, and therefore on the Edge of Sliding Rules, the Foot is generally divided into 100 equal Parts, numbred, 20, &c. to 100, and oftenti the whole two Foot onwa from 100 to 200.

Sometimes Dimenſions Glaſs are taken in Inches Quarters of Inches, tho' rarely, which when they are

This is the Analogy.

As 144 which is the firſt fixt Number for Foot Meaſ accounted on the Stock.

Is to the Breadth taken Inches accounted on the S

So is the Length accoun in Inches on the Stock to Content on the Slip required

Example. A Pane of G 31 Inches a half in Length 8 ½ Inches in Breadth, what the Content?

Practice. Set the Bread 8 ½ in the Slip to 144 in Stock, and againſt 31 Inches the Length ſtands 1. 86 in Slip, which is the Content quired.

The Uſe of the Carpenters jo Rule.

The Application of the ches in Meaſuring Lengt Breadths, &c. is obvious, t of *Gunter*'s Line. See u der the Line of NUMBERS.

The Breadth of any Surfa as Board, Glaſs, &c. being g ven; to find how much in Leng makes a ſquare Foot.

Find the Number of Inch

he Surface is broad in the Line of Board Measure, and right against it is the Number of Inches requir'd.

Thus if the Surface were eight Inches broad, 18 Inches will be found to make a Superficial Foot.

Or more readily thus apply the Rule to the Breadth of the Board or Glass; that Edge mark'd 36, being even with the Edge, the other Edge of the Surface will shew the Inches, and quarters of Inches, which go to a square Foot.

The Use of the Table at the End of the Board Measure.

If a Surface be one Inch broad, how many Inches long will make a Superficial Foot? Look in the upper Row of Figures for one Inch, and under it in the second Row is 12 Inches, the Answer to the Question.

The Use of the Line of Timber Measure.

This resembles the former, for it being known how much the Piece is square; look for that Number on the Line of Timber Measure; the Space thence to the End of the Rule is the Length, which at that Breadth, makes a Foot of Timber: thus if the Piece be nine Inches square, the Length that is requir'd to make a Solid Foot of Timber, is 21$\frac{1}{3}$ Inches.

If the Timber be small and under nine Inches square, seek the Square in the upper Rank of the Table, and immediately under it are the Feet and Inches that make a solid Foot, thus if it be 7 Inches square, 2 Foot, 11 Inches, will be found to make a solid Foot.

If the Piece of Timber be not exactly square; but broader at one End than the other; the Method is to add the two together, and to take half the Sum for the Side of the Square.

For *Round Timber*, the Method is to girt it round with a String, and to allow the fourth Part for the Side of the Square. But this Method is erroneous, for by it there is lost above $\frac{1}{5}$ of the true Solidity.

RULE of THREE }
RULE of PROPORTION } commonly call'd the GOLDEN RULE is a Rule which teaches how to find a fourth Proportional Number to three others given.

RUSTICK [in *Architecture*] a Manner of Building in Imitation of Nature, rather than according to the Rules of Art, the Columns are encompass'd with frequent Cinctures.

RUSTICK WORK, is where the Stones, *&c.* of the Face. *&c.* of a Building instead of being smooth, are hatch'd or pick'd with the Point of a Hammer.

RUSTICK ORDER, is an Order with *Rustick* Quoins, Rustick Work, *&c.* *Felibien* says, 'tis properly where the several Parts of the Five Orders are not exactly observ'd, but this confounds *Rustick* with *Gothick*.

S.

SAGITTA [in *Architecture*] *i. e.* an Arrow, which the *Italians* call *Saetta*, is what we call the Key-Piece of an Arch.

SALON } [in *Architec-* SALOON } *ture*] is a very lofty ſpacious Hall, vaulted at Top, and ſometimes comprehending two Stories or Ranges of Windows, as that at *Blenheim* Houſe.

The *Saloon* is a grand Room in the middle of a Building, or at the Head of a Gallery, *&c.*

Its Faces or Sides ought all to have a Symmetry with each other; and as it uſually takes up the Height of two Stories, its Ceiling, as *Daviler* obſerves, ſhould be with a moderate Sweep.

The *Salon* is a State Room. Theſe are much us'd in the Palaces in *Italy*, and from them we took the Mode.

Saloons are frequently built ſquare, and ſometimes octogonal, as at *Marli*, and ſometimes in other Forms.

Embaſſadors and other great Viſitants, are uſually receiv'd in the State Room.

The Bottom of its Plafond ought to be arch'd, as is practiſed in ſome of the Palaces of *Italy*.

SAMEL or SANDEL *Bricks* See *Bricks*.

SAND, is a fine, hard, gravelly Earth of great Uſe in Building, and other Works.

There are three Sorts of Sand diſtinguiſh'd by the Places whence they are drawn, *viz. Pit-ſand*, *River-ſand*, and *Sea-ſand*.

Sand is us'd in Building, as one of the Ingredients in Mortar.

For this Uſe Pit-Sand is of all the beſt, and of Pit-Sand the whiteſt is always the worſt.

Of *River-ſand*, that found in the Falls of the Water is the beſt, becauſe moſt purged.

Sea Sand is the worſt.

Pit-ſand, as being fat and tough, is moſt us'd in Building Walls and Vaults.

River-ſand, ſerves for *Rough Caſting*.

All Sand is good in its kind, if when ſqueez'd and handled it crackles, and if being put on a white Paper, *&c.* it neither ſtains nor makes it foul.

That Sand is naught, which mixt with Water makes it dirty, and which has been long in the Air; for ſuch will retain much Earth and rotten Humour. And for this Reaſon ſome Maſons waſh their Sand before they uſe it.

De Lorine obſerves, that the Sand of *Puzzuolo* is the beſt in the World, eſpecially for maritime Building.

Some diſtinguiſh Sand into *Male* and *Female*. The *Male* Sand is of a deeper Colour than another Sort of Sand in the ſame Bank or Bed, call'd *Female* Sand.

Founders make Uſe of Foſſil Sand. It is properly a yellow fat Earth, whereof they make their Moulds for the Caſting of ſmall Work, whence they call it *Caſting in Sand*.

The Plumbers uſe Sand in moulding

Moulding ſeveral of their Works, particularly large Sheets.

To prepare this Sand for their Sheets, they wet it lightly, ſtir and work it with a thick, and then they beat and plane it.

Sand at *London* is commonly ſold for 3 *s. per* Load, 36 Buſhels to the Load.

In ſome Parts of *Suſſex* and *Kent*, 'tis ſold for 18 *d. per* Load, at 12 Buſhels to the Load. In other Parts of *Suſſex* 'tis ſold at 2 *s.* 6 *d. per* Load, at 18 Buſhels to the Load.

SASH-LIGHTS. See *Painting.*

SASH-FRAME. See *Painting.*

SAW, is an Inſtrument ſerving to cleave or divide into Pieces divers ſolid Matters, as Wood, Stone, Marble, &c.

The Workmen who make the greateſt Uſe of the Saw are the Sawyers, Carpenters, Joiners, &c.

The beſt *Saws* are made of Steel, ground bright and ſmooth; thoſe of Iron are only Hammer harden'd; and thence the firſt, beſides their being ſtiffer, are likewiſe found ſmoother than the laſt.

You may know, whether or not they have been well hammer'd, by the ſtiff bending of the Blade; and if they have been well and evenly ground, by bending equally in a Bow.

The Edge in which the Teeth are, is always thicker than the Back, becauſe the Back is to follow the Edge.

The Teeth are cut and ſharpen'd by a Triangular File, the Blade of the Saw being firſt fix'd in a Whetting Block.

After they have been fil'd, the Teeth are ſet, that is to be turned aſkew, or out of the Right-Line, that they may make the Kerf or Fiſſure the wider, that the Back may follow the better.

This they perform by putting an Inſtrument call'd a *Saw-Wreſt*, between every other two Teeth, and giving it a little Wrench towards you, and the other a little from you.

The Teeth are always ſet ranker for coarſe, cheap Stuff, than for hard and fine, becauſe the ranker the Teeth are ſet, the more Stuff is loſt in the Kerf, and if the Stuff be hard, the greater the Labour in ſawing it.

But of all *Mechanicks* there are none have ſo many as the Joiners, nor ſo many different Kinds, as

The *Pit-ſaw*, a large two handed Saw, us'd to ſaw Timber in Pits. It is ſet rank for coarſe Stuff, ſo as to make a Kerf or Fiſſure of almoſt a quarter of an Inch; but for finer Stuff, finer.

The *Whip-ſaw*, which is alſo two handed, us'd in ſawing ſuch large Pieces of Stuff as a Hand Saw will not eaſily perform.

The *Hand-ſaw* is made for a ſingle Man's Uſe. Of theſe there are various Kinds, as the *Bow* or *Frame* Saw, furniſh'd with Cheeks; by the twiſted Cord and Tongue in the middle of it, the upper Ends are drawn cloſe

close together, and the lower set further apart.

The *Tenant-saw*, which being very thin, has a Back to keep it from bending.

The *Compass-saw*, which is very small, and its Teeth usually not set; the Use of it is to cut a round, or any other Compass Kerf; for which Purpose, the End is made broad, and the Back thin, that it may have a Compass to turn it.

SAWING, the Application of the SAW in dividing of Timber, &c. into Boards.

There are Mills for sawing of Wood, carried both by Wind and Water, which perform it with much more Expedition and Ease, then is done by the Hand.

These Mills consist of parallel Saws, which rise and fall perpendicularly by the Means of one of the grand Principles of Motion.

These require but a very few Hands, *viz.* only to push along the Timber, which are either laid on Rollers, or suspended by Ropes, in Proportion as the *Sawing* advances.

These are frequently found abroad; and were lately begun to be introduc'd into *England*, but the Parliament thought fit to prohibit them, because they would spoil the Sawyers Trade and ruin a great many Families.

M. *Felibien* in his Principles of *Architecture*, makes mention of a Kind invented by one *Missien*, Inspector of the Marble Quarries in the *Pyrenees* by Means of which, Stones are sawn even in the Rock it self out of which they are taken.

Some of these, he says, are 2[illegible] Foot long, made of Iron, without Teeth; but he does no[t] describe either their Form o[r] Application.

Sawyers most commonl[y] work by the Hundred, that i[s] by the hundred Superfici[al] Feet, for which they have va[-]rious Prices, not only in diffe[-]rent Places, but also for di[f-]ferent Kinds of Timber, [as] will appear by the followin[g] Articles.

Oak; the sawing of *Oak* [is] in some Places 2 *s.* and 8 *d.* i[n] others 3 *s.* in others 3 *s.* 6 *d.* th[e] hundred.

Elm; the sawing of *Elm* [is] in some Places, 3 *s.* the hu[n-]dred; commonly about th[e] Price of Oak.

Ash and *Beach*. The sawin[g] of *Ash* and *Beach* is generall[y] worth 6 *d.* in the Hundred mo[re] than Oak or Elm. In som[e] Places 'tis 3 *s.* in others 3 *s.* 6 [*d.*] in others 4 *s.* *per* Hundred.

By the Load. Sawyers som[e]times work by the *Load*; *vi[z.]* so much for cutting out a Lo[ad] (or 50 Foot) of Timber; th[e] Price of which is various, a[c]cording what the Timber is c[ut] to. But the common Price [is] 10 *s.* the Load for *Ship Plank* of two Inches thick; and f[or] Building

Timber	Large Size, 6 *s.* or 6 *s.* 6 *d.*	the Load.
	Large Size, 7 *s.*	
	Small Size, 7 *s.* 6 *d.* or 8 *s.*	

Wh

When *Sawyers* ſaw by the oad, they commonly agree r it as follows.

They have all their Sizes hich they are to cut, ſet down; d they will cut none ſmaller, either will they ſlab any, unſs they are paid for it by eaſure, over and above what ey are to have by the Load.

They never cut any Thing ſs than Rafters, which are out four and five Inches, and hich is generally the ſmalleſt imber in a Frame, except uarters and Window Stuff, hich they generally cut by the undred.

If the Carpenter will have y Pieces clear'd by ſlabbing, ter they have cut them off their Size, they will alſo be id by Meaſure for it.

They generally prick off eir Sizes from the outward dges, and what is left in the iddle, they lay by till they n fit it to ſome other Size, en it is wanted.

A Carpenter has a great Deal Labour in hewing off outle Pieces, when 'tis ſaw'd by e Load.

Sawing by the Load is comonly reckon'd good Work for e Sawyer; but it waſtes a eat Deal of Timber, it being w'd away to Chucks.

The loweſt Price in *Suſſex* is . the Load, and if it be not in very large Scantlings, y will have 7 *s.* which is the mmon Price for ſawing a d large ſiz'd Timber Frame. t if the Timber Frame be ll and ſlight, they will have nd 6 *d.* or 8 *s. per* Load.

Of Ship Planks] are cut by the Load for about 10 *s.* at two Inches thickneſs.

If they are ſawn by the hundred, they have 3 *s. per* Hundred, and 2 *d.* for *Petting* of every Log.

If they have nothing allow'd for *Petting*, then they reckon ſo many Carves as there are Pieces, which is one Carve more than there really is.

They commonly cut Planks from 1 ½ Inch to 3 Inches thick; but they are never paid for breaking Work, till it comes to a two Foot Carf.

Of Compaſs Work] (as Mill Wheels, Furnace Wheels, Forge Wheels, Rafters for Compaſs Roofs, &c.) they have 2 *d. per* Foot.

Bevil Work] For ſawing of Bevil Work (as Hips and Sleepers, &c. Poſts, &c. in Bevil Frames; as alſo Poſts or Punchins in Polygonal Turrets, &c. alſo Cant Rails) they work by the Hundred; but they always reckon a Carf and a half; that is, they reckon half as many more Feet of ſawing as there is.

Furnace Bellows are cut by the Foot Lineal Meaſure, at 1 *s. per* Foot.

Forge Bellows are cut by the Foot Lineal Meaſure, at 4 *d.* or 6 *d. per* Foot.

Ground Guts are alſo cut by the Foot Lineal Meaſure, if ſmall, at 1 *d. per* Foot; but if 15 Inches deep, at 1 ½ *d.* if 18 Inches, at 2 *d. per* Foot.

The Meaſuring of Sawyers Work is generally done by the Foot Superficial Meaſure.

There is no Difficulty in taking the Dimenſions, for they reckon the Depth of the Carf for the Breadth, and the Length for the Length.

The Breadth (or Depth) and Length of a Carf being taken and multiply'd together (by croſs Multiplication) gives the Area or Superficial Content of the Carf.

Having found the Number of Feet in one Carf; multiply it by the Number of Carves of the ſame Depth and Length, and ſo you have the Area of them all.

Note 1. That when they have thus caſt up their Work in Feet, they are paid for it by the Hundred [that is 100 Feet] at various Rates.

2. That if the Carf be bu[t] ſix Inches (or be leſs than ſi[x] Inches) in Depth, they have a Cuſtom of being paid for Car[f] and half (as they phraſe it) tha[t] is for half ſo much more as i[t] comes to by Meaſures.

The Reaſon they urge fo[r] this Cuſtom is, their Troubl[e] in often Linding and removin[g] their Timbers.

3. *That for breaking Wor[k]* [that is cutting a Log throug[h] the middle] and *Slabbing* [tha[t] is cutting off the out-ſide Pie-ces] if the Carf be more tha[n] 12 or 13 Inches deep, they ar[e] paid by the Foot Lineal Mea-ſure, at various Prices, accord-ing to the different Depth o[f] the Carf.

Inches deep,	per Foot.
15	1 *d.*
18	$1\frac{1}{2}$
20	2
22	$2\frac{1}{2}$
24	3
26	$3\frac{1}{2}$
28	4
30	$4\frac{1}{2}$
32	5
34	$5\frac{1}{2}$
36	6

That in ſome Places 'tis the Cuſtom to allow the Sawyer but one Breaking Carf in a Log; but ſome Sawyers claim it as a Cuſtom to have *Half Breaking Work*; as if they have four deep *Curves*, then they will have two Breaking Works, and the other two hundred Work.

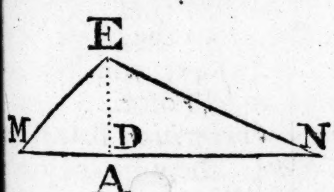
SCABELLUM [in the a[n]tient *Architecture*] was a ki[nd] of Pedeſtal, uſually ma[de] Square, ſometimes Polygon[al] very high and ſlender, co[m]monly ending in a ſort of Shea[th] or Scabbard, or profil'd in t[he] Manner of a Balluſter. T[he] Uſe of it is to bear *Buſto's* R[e]*lievo's*, &c.

SCA

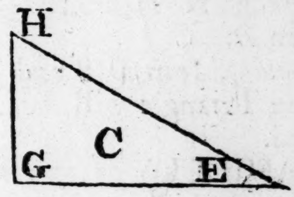
SCAFFOLD [in *Architecture*] is an Assemblage of Planks and Boards, sustain'd by Tressels and Pieces of Wood fixt in the Wall, upon which Masons. Bricklayers, &c. stand to work in building high Walls, &c. and Plasterers, &c. in Plastering Cielings, &c.

SCALE [in *Mathematicks*] signifies any Measures or Numbers which are commonly used; or the Degrees of any Arch of a Circle, or of such right Lines as are described; from thence, such as Sines, Tangents, Chords, Seconds, &c. drawn or plotted down upon a Ruler for ready Use and Practice in Geometrical and other Mathematical Operation.

A SCALENE *Triangle* } is SCALENUM *Triangle* } a Triangle whose 3 Sides are unequal to one another, as the Triangles C and D.

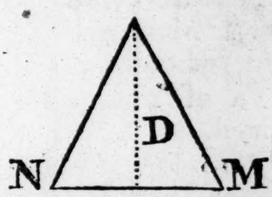


Here Note, that when one of the Angles of a Scalene Triangle is right angled, as the Triangle C, right Angle at G, then such a Triangle is called a right angled plain Triangle,

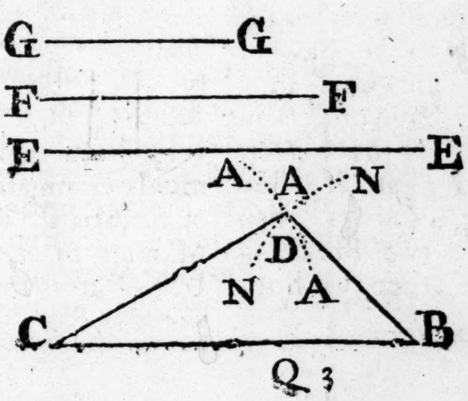


wherein the Side E G is called the Base; the Side H G, the Perperpendcular, and the Side E H, the Hypothenuse.

Note also that in all Triangles, wherein a Line is drawn from any Angle to the opposite Side, and cuts the same at right Angles as the Line D, such a Line is call'd the Perpendicular of the Triangle, and the Side on which it falls, as N M, is called the Base.



To describe the SCALENUM *Triangle* A B C, whose Sides shall be equal to the 3 Lines given E E, F F, and G G.



First, Make B C = E E, and on C B, with the Distance F F describe the Arch A A, and on B with the Distance F F, the Arch N N, intersecting A A in D.

Secondly, Join D B and D C, and the Triangle will be compleated.

SCAMILLI *impares* [in the *ancient Architecture*] are certain Benches, Blocks or Zocco's, which serve to raise the rest of the Members of an Order, Column, Statue or the like, which was placed before the Horizon, *i. e.* beneath the Projectures of the *Stylobata Cordices* and other Saillies, and to prevent their being lost to the Eye, which may chance to be plac'd below their Level; or below the Projecture of some of the Ornaments of it.

SCANTLING [in *Carpentry*] is a Measure, Size or Standard, whereby the Dimensions, &c. of Things are to be determined.

SCAPUS [in *Architecture*] the Fust or Shaft of a Column.

SCENOGRAPHY is in Perspective a Representation of a Body on a Perspective Plane; or a Description thereof in all its Dimensions, such as it appears to the Eye.

The Ichnography of a Building, &c. represents the Plan or Ground Work of the Building; the *Orthography*, the Front or Upright of it; and the *Scenography*, the whole Building, the Front, Sides, and Height, and all.

SCHEME, is the Representation of any Geometrical Figure by Lines sensibly to the Eye.

SCHEME. See Arches.

SCIMA *reversa* is an O G, with the hollow Side downwards.

SCIMA. See *Cima*.

SCIOGRAPHY, the Profile or Section of a Building cut in Length and Breadth, to shew the Inside of it.

SCOTIA [in *Architecture*] is a Semi circular Cavity or Channel, between the Tores in the Bases of Columns; or between the Thorus and the Astragal, and sometimes 'tis put under the drip in the Cornice of the *Dorick* Order.

The *Scotia* has an Effect just opposite to that of the Quarter round.

Our Workmen frequently call it the Casement.

M. *Perrault* calls it a hollow obscure Moulding between the Tores of the Base of a Column.

It is also call'd by some the concave Member, and by others *Trochilus*, from the *Greek*, *Trochylos*, a Pulley, which it resembles as to Form.

In the *Corinthian* Base there are 2 *Scotia*, the upper of which is the Smaller. According to *Felibien*, the *Cavetto* is a fourth Part of the *Scotia*.

SCREW } is one of the Mechanical Powers,
SCRUE } consisting of a Cylinder sulcated, or hollowed in a spiral Manner, and moving or turning in a Box, or Nut cut so as to answer exactly, chiefly used in Pressing or Squeezing Bodies close; but sometimes also in raising Weights.

If the furrowed Surface be convex, the Screw is said to be

Male

Male; if concave, 'tis *Female*.

Where Motion is to be generated, the *Male* and *Female* are always joined; that is, whenever the Screw is to be used as a simple Engine or Mechanical Power.

When it is join'd with an Axis in Peritrochio, there is no Occasion for a Female; but in that Case it becomes Part of a Compound Engine.

In the Screw, the Power is to the Resistance, as the said Distance between 2 Threads to the Periphery of a Circle, run through by that Point of the Handle to which the Power is apply'd. Or,

SCREW, is a Cylinder cut into several concave Surfaces, continually inclin'd, or in plain Terms, it is the wedge winded about the Convexity of a Cylinder, with a certain and equal Inclination, whose each Circumvolution is call'd a *Helix*, or Thread of the Screw, O,NMLKH. See *Plate*, *Fig*. 1.

This Engine is very useful for moving or pressing with great Force.

It was from the right angled Triangle, or inclin'd Plain, that the first hint was given to the Inventors of the *Screw*, which was made by the winding the said Triangle about the Convexity of a Cylinder, as the Triangle H K I, about the Cylinder H I P Q; whereby it became of more Use, and was contain'd in less Space: for which End the Height of the Triangle has been allow'd for H K; the Height of the Cylinder, and the Inclination of the Hypothenuse of the said Triangle has been given to the *Helix* or Thread H K, and so in like Manner to all the other *Helixes* that go upwards round about the Cylinder of the Screw, which in Fact makes the Thread or Helix an actual spiral Line, wound about the Convexity of the Cylinder.

Since that the Screw is no other than the wedge, it therefore follows, that if a Power sustain a Weight by means of a Screw, that Power will be to that weight as the height of the Screw is to the Head of the Screw.

That is, if the whole Line or Thread of the Screw was unwound from the Convexity of the Cylinder, and laid at full Length;

Then the Power apply'd.

Will be to the Weight that it will Equipoise.

As the Height of the Cylinder is to the Length of the extended Thread.

Whence it is easy to conclude, that in a Screw, the Force of the Power is the greater, the nearer the Circumvolutions of the Thread are together, and the more they are inclin'd to the Horizon; because then the Height of the Cylinder is capable of containing a greater Length of the *Helix* or Thread, and consequently the *Helix* will have a greater Ratio to the Height of the Cylinder, whereby the Power will likewise have a greater Ratio to the Weight to be rais'd.

But to make an Estimate of the Force of the Screw, there is no Occasion to Measure the

whole Length of the Thread, nor the Height of the whole Cylinder; for if it be known how often the Height of one Thread from the other is contain'd in one Circumvolution or *Helix*, that is how often the Height H L is contain'd in the circuit of the *Helix* H K L, because H P, the whole Height of the Cylinder, is contain'd just as many times in the whole Thread of the Screw H K L M N O P, and therefore the Force is the same. See *Pl. f.* 1.

Hence 'tis plain that the Screw can raise a Weight by one *Helix* or Thread, no higher tha from H to L, and that if the Height H L is contain'd ten times in the Helix H K L; a heavy Body will by Means of this Engine be sustain'd by a Power little more than equal to $\frac{1}{10}$ Part of its Weight.

This Engine is always work'd with a Lever of the second Kind (as the preceeding Figure) as A C, whose *Fulcrum* is the Centre of the Cylinder A: Distance of Weight = the Radius of the Cylinder and Power at C, &c. and as has been before prov'd, that the further the Power is applied from the *Fulcrum* of a Lever, the greater is its Force; so it is plain, that by increasing the Length of the *Lever*, the Force may be also increas'd at Pleasure; but then what is here gain'd in Force, will be lost in Space, as has been already prov'd in all the preceeding Engines. *f.* 2.

SCRIBING [i *Joinery* &c.] is a Term us'd when one Side of a Piece of Stuff is to be fitted to the Side of some other which last is not regular Therefore to make these tw Pieces join close together al the Way, they *scribe* it thus they lay the Piece of Stuff the intend to *scribe*, close again the other Piece of Stuff the intend to *scribe* to, and ope their Compasses to the wides Distance; these two Pieces o Stuff bear off each other then the Compasses (movin stiff in their Joint) they bea the Point of one of the Shank against the Side they intend t *sc ibe* to, and with the Point o the other Shank they draw Line on the Stuff they inten to be *scrib'd*.

Thus have they a Line o the irregular Piece, parallel t the Edge of the regular one and if the Stuff be wrough away exactly to the Line whe these Pieces are put together they seem a Joint.

SCROWLS [in *Architec ture*] See *Volute*.

SCULPTURE, is the Ar of Cutting or Carving in Woo Stone or other Matter, to form various Figures for Represen tations: Sculpture in its Lati tude, includes both the Art o working in *Creux*, properl call'd *Engraving*, and of work ing in *Relievo*, which is wha in Strictness is call'd Sculptur

It is also us'd to signify th fashioning of Wax, Earth Plaister, &c. to serve as Mo dels or Moulds, for the ca ing of Figures of Metals in.

SCUPPER *Nails*. See *Nail*

SEASONING of TIMBE is the preparing of Timber fo

Use

ſe: the *Timber* being fell'd, c. muſt be laid up very dry an airy Place, yet out of the ind or Sun; others ſay it ght to be free from the Extremities of the Sun, Wind d Rain; and that it may not ave but dry equally, you y dawb it over with Cow ng; let it not ſtand upright, t lie along one Piece upon other, interpoſing ſome ſhort ocks between them, to preve them from a certain ouldineſs, which they uſual- contract while they ſweat, d that often produces a kind *Fungus*, eſpecially if there e any ſappy Parts remaining.

Some again keep their *Timbe*r as moiſt as can be, by ſubrging it in Water, to prent its cleaving; and this is od in Fir and other Timber , both for the better Stripg and Seaſoning.

When the Boards therefore e lain a Fortnight in Water, y muſt be ſet upright in the n and Wind, ſo as it may ely paſs through them, eſpelly during the Summer ats, which is the Time of iſhing Buildings, and turn'd ly; and thus even new ſawn rds will floor much better n thoſe of a many Years Seaſoning.

But to prevent all poſſible cidents, when Floors are laid, the Joints be ſhot, fitted tack'd down for the firſt r, nailing them for good all the next; whereby they lie ſtanch cloſe, and with- ſhrinking in the leaſt; as they were all of one Piece.

Water Seaſoning among *Wheelwrights*, is of ſpecial Regard: As for the Elm, tho' the Tree be fell'd never ſo green, for ſudden Uſe, if plunged four or five times in Water, eſpecially Salt, which is beſt, it obtains an admirable Seaſoning, and may be immediately us'd.

Beſides which Method, ſome again commend burying in the Earth; others, in Wheat; and there are alſo Seaſonings of the Fire, as for the ſcorching and hardening of Piles, which are either to ſtand in Water, or the Earth: Sir *Hugh Plat* informs us, that the *Venetians* us'd to burn and ſcorch their *Timber* in a flaming Fire, continually turning it round with an Engine, till they have got upon it a hard, black, coaly, Cruſt, whereby the Wood is brought to ſuch a hardneſs and dryneſs, that neither Earth nor Water can penetrate it.

Mr. *Evelyn* ſays he had ſeen Charcoal dug out of the Ground, amongſt the Ruins of the ancient Buildings, which in all Probability had lain cover'd with Earth above 1500 Years.

As for *Poſts*, and the like that ſtand in the Ground, the burning the outſides of the Ends that are to ſtand in the Ground to a Coal, is a great Preſervative of them, and ſome have practis'd the burning the Ends of *Poſts* for *Railing* and *Paleing*, with good Succeſs.

It likewiſe appears by the Abſtract of a Letter written by *David Vonderbeck*, a *German* Philoſopher and Phyſician, at *Min-*

Minden, to Dr. *Largelot*, in the Philosophical Transactions, that the same is practiced in *Germany*. The Words are as follows.

Hence also we slightly burn the Ends of Timber *to be set in the Ground, that so by the Fusion made by the Fire, the volatile Salt, which by Accession of the Moisture of the Earth would easily be consum'd to the Corruption of the* Timber, *may catch and fix one another.*

SECANT, is a Line drawn from the Centre of a Circle, cutting it and meeting with the Tangent without.

SECTION [in the *Mathematicks*] signifies the cutting of one Plane by another; or a Solid by a Plane.

SECTION of a Building [in *Architecture*] is understood of the Profile and Delineation of its Heights and Depths, rais'd on a Plane, as if the Fabrick were cut asunder to discover the Inside.

SELLS [in *Architecture*] are of two Kinds, *viz. Ground Sells* [which are the lowest Pieces of Timber in a Timber Building, on which the whole Superstructure is erected] and *Window Sells* (sometimes call'd Window Soils) which are the Bottom Pieces in a Window-Frame.

The *Price of putting* in Ground Sells in a House, is commonly rated at 3 *d.* or 4 *d.* a Foot, for Workmanship only.

SERPENTINE *Line*; the same with *Spiral*.

SESQUITERTIONAL *Proporional*, is when any Number or Quantity contains another once and one third.

SETTING. See *Pitching*.

SETTING *of Fronts*. See *Fronts*.

SEWERS [in *Architecture*] are Shores, Conduits, or Conveyances for the Suillage and Filth of an House.

Sir *Henry Wootton* advises that Art imitate Nature in these ignoble Conveyances, and separate them from Sight (where there wants a running Water) into the most remote, lowest and thickest Part of the Foundation, with secret Vents passing up through the Walls to the wide Air, like Tunnels; which all the *Italian* Architects commend for the Discharge of Vapours, though elsewhere but little practised.

SEXANGLE [in *Geometry*] is a Figure consisting of six Angles.

SHADOW [in *Opticks*] is a Privation of Light, by the Interposition of an opake Body; but as nothing is seen but by Light, a mere Shadow is invisible; therefore when we say we see a Shadow, 'tis partly that we see Bodies plac'd in the Shadow, and illuminated by Light, reflected from collateral Bodies; and partly that we see the Confines of Light.

If the opake Body which projects the Shadow, be perpendicular to the Horizon, and the Place 'tis projected on be horizontal, the Shadow is called a *Right Shadow*: Such are the Shadows of Men, Trees, Buildings, &c.

If the Opake Body be plac'd rallel to the Horizon, the adow is call'd a *versed Shaw*, as the Arms of a Man etch'd out.

Laws of the Projection of IADOWS *from Opake Bodies.*

1. Every opake Body proSts a *Shadow* in the same Dition with its Rays; that is, wards the Part opposite to Light. Hence as either the minary or the Body chans Place, the Shadow likewise anges.

2. Every opake Body prots as many Shadows as there Luminaries to enlighten it.

3. As the Light of the Lunary be more intense, the adow is the deeper. Hence Intensity of the Shadow is easured by the Degrees of ght that Space is derived om.

4. If a luminous Sphere be ual to an opake one, it illunes; the Shadow this latter ojects, will be a Cylinder; d of Consequence, will be opagated still equal to it f, to whatever Distance the minary is capable of acting: that if it be cut in any Place, Plane of the Section will a Circle equal to the great rcle of the opake Sphere.

5. If the luminous Body be eater than the opake one, the adow will be conical. If erefore the Shadow be cut by Plane parallel to the Base, Plane of the Section will a Circle, and that so much less, as it is at a greater Dince from the Base.

6. If the luminous Sphere be less than the opake one, the Shadow will be a truncated Cone, and of Consequence it grows still wider and wider, and therefore if cut by a plane Parallel to the Section, that Plane will be a Circle so much the greater, as 'tis farther from the Base.

SHAFT [in *Architecture*] as the *Shaft of a Column*, is the Body of it, thus call'd from its straitness; but is more frequently call'd by Architects the Fust.

Shaft is also us'd for the Spire of a Church Steeple.

The *Shaft* of the *Tuscan* Column, says M. *Le Clerc*, always terminates at the Top with an Astragal, and at Bottom with a Fillet, which in this Place is call'd *Orla*.

The Shaft usually diminishes in Thickness towards the Top; and this Diminution commences from a third Part of its Height; that is to say, the Height of the Shaft being divided into three equal Parts, the first of them is equal or cylindrical, and the two others diminish imperceptibly to the Astragal, where the Diminution terminates.

Some give a little Swelling to their Columns; that is, they make the Shaft somewhat bigger towards the Top of the first third of its Height, than towards the Bottom; or rather they diminish the Bottom of the Shaft, and by this Means make the upper Part of the first Division appear to swell.

But this Diminution at the Bot-

Bottom of the Shaft ought never to exceed one Minute or one Minute and a half at the utmost. The Truth is, there ought to be no Swelling at all in a Column, excepting where there is some particular Reason for it; as where the Orders are plac'd over one another.

Some very considerable Architects, on Occasion encompass the Shafts of their Columns with several Cinctures or Fillets imboss'd. But these Kind of *Rustick* Ornaments, says M. *Le Clerc*, are never to be imitated, excepting in the Gates of Citadels, or Prisons, in Order to render their Entrance more frightful and disagreeable.

This too must be observ'd, that if these *Rustick* Ornaments may be admitted any where, 'tis only in *Tuscan* Columns, or at most in *Doric*; and never in the other more delicate Orders, especially where they are fluted.

SHAKY } [with *Builders*]
SHAKEN } such Stuff as is crack'd either with the Heat of the Sun, or the Drought of the Wind.

SHARD NAIL. See *Nails*.

SHEATHING NAILS. See *Nails*.

SHEET LEAD. See *Lead*.

SHIDES } [in *Building*]
SHINGLES } are small Pieces of Wood or quarter'd oaken Boards, sawn to a certain Scantling, or more usually cleft to about an Inch thick at one End, and made like Wedges four or five Inches broad, and eight or nine Inches long.

They are us'd in Covering more especially Churches an Steeples, instead of Tiles Slates.

This Covering is dear, y where Tiles are very scarc and a light Covering requir' is preferable to Thatch, made of good Oak, and clef not sawed, and then well se son'd in Water and the Su they make a sure, light an durable Covering: The Build ing is first to be covered a over with Boards, and th Shingles nail'd thereon.

The *Price of Shingles* ar sometimes 20 *s. per* Thousand but these are bad Ware; if the are good, they are worth 30 *per* Thousand; and 40 *s.* Thousand have at sometime been given for Shingles to la on Steeples; for those that li on high, and hang so Perpen dicularly, ought to be of th best Sort.

The common Price of cleav ing and making of Shingles, 10 *s. per* Thousand.

A Tun of Timber will mak about 3000 Shingles.

Of *Laying on Shingles*] I Order for Covering with Shin gles, the Building must be firs covered with Boards, whic being done, the Shingles ar fastened to those Boards, wit 4 *d.* 5 *d.* or 6 *d.* Nails, in eve ry Course at a certain Gag *viz.* at 3½ Inches or 4 Inche from under one another; fo they commonly make thre Waters (as they phrase it) tha is, they usually hang thre Shingles in Height, in th Length of one; so that if th

Shingle

hingles are 12 Inches long, ey are laid at four Inches age.

In Breaking Joint they do t observe to make one Joint er the middle of another; it they sometimes break Joint Inch, an Inch or a half, or o Inches, according to the readth of the Shingles, for ey (especially if they are eft) are not exactly of a Size.

As *for the Price of laying on hingles.*] For laying them Spire Steeples, where the ork is high and troublesome, ey have usually 20 *s.* a Thouand, but for lower Work (as oon Houses and the like) they ill both cleave, make and lay hem on for the same Price, or they only lay them on, they ill do it for 10 *s. per* Thouand.

For dressing old Shingles, that is for hewing them and tting off the ragged lower nds] they have about 6 *s. per* Thousand.

As to the *Number of Shines* that will cover a Square, Shingles of four Inches road, and laid at four Inch age, will cover a Yard square, d consequently 900 will coer a Square (or 100 Superfial Feet) of Healing; but it is sual to allow 1000 to a Square, ecause the Shingles seldom old out to be all four Inches uare, and to a 1000 Shines, they allow a 1000 Nails.

SHINGLING the Covering ith Shingles.

SHINLOG. See *Bricks.*

SHIP-WRIGHT. How to aw a Ship-Wrights Arch, by the Intersection of Right-Lines.

First, Draw the Base Line A B, and erect the perpendicular Lines A C and B D, the Heights of which answer to the Rake of the Arch or Ceiling of the Cabin, and draw the Line C D, and divide it in the middle at E; then divide A C into any Number of equal Parts, and C E into the same Number of Parts; also B D into any Number of equal Parts, and D E into the same; then draw Right Lines into each correspondent Divivisions which will create the Arch A E B, (which was required. See *Plate*, *Fig.* 3.

SCHOFEET. To draw the two different Edges of a twisted Schofeet.

The Figure 4 in the Plate, represents the inward and outward Edges of a twisted Schofeet of a Semi-Circular Window, whose Jaumbs splay more or less, and whose Crown lies level without splaying; the Arch C G D is the Edge next the Head of the Window, and the Arch A G B is the Edge next the Room: The Question is, to draw the inward Arch A G B, so that it shall diminish gradually from nothing at the Crown G, to the Splays of the Jaumbs, at the Springing A C and D B.

First, Draw the Base Line A B, equal to the Width of the Window and Splays of both Jaumbs, and divide it in the middle at H, then set on the Splays from A to C, and from B to D.

When you have done this, take

take H C or H D in your Compasses, and set one Foot in H, and with the other strike the Arch C G D.

Erect the dotted Lines C E D F, equal to H G, and perpendicular to A B, and draw the Line E F, also the Lines A E and B F, into any Number of equal Parts; also E G and G F, and draw Right Lines to their correspondent Divisions, and they will form the Arch A G B, which will splay gradually from nothing at G to A C and D B, which is the Question requir'd.

SHOP WINDOWS, these may be afforded to be done at the same Rate as batten'd Doors, besides the Iron Work, as Bolts, Staples, Hinges, Locks, Keys, Latches, Chains, *&c.*

SHREADINGS, the same as *Furrings.*

SILERY, the same as *Cilery.*

SIZE for Gilding both with Silver and Gold.

For Gold *Size*, take yellow Oaker and grind it on a Stone with Water, till it be very fine, and afterwards lay it on a Chalk Stone to dry; this is the common Way; or you may wash it, as is taught in the Article WASHING of Colours; for when 'tis wash'd, to be sure nothing but the purest of the Colour will be us'd, and besides it is done with less daubing.

When the Oaker has been thus prepar'd, grind it as you do other Oil Colours, only with fat drying Oil; but it is something more laborious Work, in that it must be ground very fine, even as Oil it self; for the finer it is, the greater Lustr the Gold will carry that is lai on it.

Here *Note*, that you mu give it such a Quantity of you fat Oil, that it may not be s weak as to run, when you hav laid it on; nor so stiff that i may not work well; but o such a competent Body, tha after it is laid on, it may settl itself smooth and glossy; whic is a chief Property of Size.

Silver *Size* is made by grind ing White Lead with fat dry ing Oil, some adding a ver small Quantity of Verdigreas to make it bind.

SKEWBACK. See *Arche*

SKIRTING BOARDS, th narrow Boards that are fitte round the underside of Wain scot, against the Floor.

SKREEN, an Instrumen us'd by Labourers in sifting Earth for making Mortar.

SLABS, the outside sapp Planks or Boards that are saw off from the Sides of a Timbe Tree.

SLATE, a blue fossil Ston very soft when dug out of th Quarry, and therefore very ea sily cut or sawn into long thi Squares or Escallops, to serv instead of Tiles for the Cover ing of Houses. The Ancient were not acquainted with th Use of Slate, and instead o them cover'd their Houses wit Shingles.

Besides blue Slate, we hav in *England* a greyish Slate which is also call'd *Horsham* Stone, because the greate Quantities of it, are found a bout *Horsham* in *Sussex.*

The *blue Slate* is a very ght, beautiful and laſting Co- ring; but then it is pretty ar, becauſe the Roof muſt firſt boarded over, and the ates hung on Tacks, and laid th finer Mortar than Tiles.

The *grey Slate* is chiefly 'd in covering Churches, Chap- ls, Chancels, &c.

The Covering with this Sort Slate, is dearer than Tiles; cauſe the Timber of the Roof uſt be very ſtrong for them, being almoſt double the eight of Tiles.

Mr. *Colepreſs* directs, that in der to judge of the Good- ſs of Slate, to knock it a- inſt any hard Body, to make yield a Sound; and ſays, if e Sound be good and clear, the one is firm and good; other- ſe its crazy,

Another Way of proving the odneſs of Slate, is firſt to igh it exactly, and then to it 6 or 8 Hours under Wa- , and then wipe it dry and igh it again, and if it weighs ore than it did before, 'tis a gn that it is of that kind, that ks in Water, and therefore ll not laſt long without rot- g the Timber or Lath.

There is alſo another Way proving it, by placing a te half a Day perpendicular- in a Veſſel of Water, ſo to reach a conſiderable ight above the Level of it: d if the Slate be firm and ſe, it will not draw Water, that the Water will not have aſ- ded above half an Inch above Level of that in the Veſſel, that, perhaps any where but at the Edges, the Texture of which might probably be looſened by hewing; but if the Stone be bad, it will have drawn Water to the very Top, be it as high as it will. There are Slates in ſeveral Places, which the moſt experienced *Slaters*, or Coverers conjecture to have continued ſeveral hundred Years, and are ſtill as firm as if firſt put up.

The *Blue Slate* cut into long Squares, or Eſcallops, makes a very handſome Appearance, and is commonly uſed in cover- ing of Summer or Banqueting Houſes in Gardens; it being a very light and laſting Cover- ing.

But if theſe Slates be rudely cut, and careleſly laid (in Re- ſpect of Form) it is then ac- counted a cheaper Covering than with Plain Tiles, eſpecial- ly in thoſe Countries where the Country affords Plenty of them.

As *to the Price of Slating*, it is valued at about 6 *d.* the Yard Square, or by the Square of 10 Foot (that is 100 Foot) from 30 *s.* to 3 Pounds or more in ſome Places.

As to the *Price* of *pointing Slates*, Mr. *Wing* ſays it is worth about 1 *s.* or 13 *d. per* Square for hewing and making them fit for the Work.

As *to the Price of Slates*, Mr. *Wing* ſays they, are worth at the Pit 12 or 14 *s. per* Thou- ſand, which will nearly do 36 ſquare Yards.

Of *Meaſuring Slating*. It is meaſured in ſome Places by the Rod of 18 Foot Square, which contains 324 ſuperficial Feet, or 36 Yards.

In

In the Measuring of this Sort of Work, where there are Gutters or Valleys, there is commonly an Allowance, which is to take the Length of the Roof, all along upon the Ridge which makes the Gutters double Measure, as much more as really it is; which is allow'd in some Places, but not in others; and so depends upon the Custom of the Place.

SLEDGE, a kind of Machine or Carriage, without Wheels, for the Conveyance of very weighty Things, as huge Stones, *&c.*

The *Dutch* have a Sort of Sledge upon which they can carry any Burthen by Land. It consists of a Plank a Foot and half Broad, and the Length of the Keel of a moderate Ship, raised a little behind and hollow in the Middle, so that the Sides go a little aslope, and are furnished with Holes to receive Pins; the Rest is quite even.

SLEEPER [in *Architecture*] is the oblique Rafter that lies in a Gutter. See *Hip.* N. 1.

SLIPPER, the same as *Plinth.*

SLUICE, a Vent or Drain for Water.

SLUICE, a Frame of Timber, Stone, or any other Matter serving to retain and raise the Water of a River, *&c.* and on Occasion to let it pass: As the Sluice of a Mill, which stops and collects the Water of a Rivulet, *&c.* to let it fall at Length in the greater Plenty upon the Mill-Wheel; such, are those used as Vents and Drains to discharge Water o[ff] Land; and such are the Sluic[es] in *Flanders*, &c. which ser[ve] to prevent the Water of th[e] Sea from Overflowing the low[er] Lands, except when ther[e] is Occasion to drown them.

Sometimes there is a kind [of] Canal inclosed between 2 Gat[es] or Sluices, in artificial Navi[gation], to save the Water, an[d] render the Passage of Boats e[qually] Easy and Safe upwar[ds] and downwards; as in the Slu[i]ces of *Briare* in *France*, whic[h] are a sort of massive Walls Bui[lt] parallel to each other, at th[e] Distance of 20 or 24 Feet, clo[sed] with strong Gates at eac[h] End, between which is a kin[d] of Canal or Chamber conside[r]ably longer than broad, wher[e]in a Vessel being inclosed, is l[et] out at the first Gate, by whic[h] the Vessel is raised 15 or 1[6] Foot, and passed out of the Ca[nal] into another much higher.

By such Means a Boat is con[vey'd] out of the *Louure* int[o] the *Seyne*, tho' the Ground be[tween] them be rais'd above 1[5] Feet higher than either of tho[se] Rivers.

SMALT, is a lovely Blue, [if] it lie at a Distance, but it mu[st] be only strew'd on upon a Groun[d] of white Lead, for it so Sand[s] that it carries no good Body [in] Oil; and besides Oil chang[es] the Colour of it, and make[s it] look quite Black, except White be mix'd with it, and they spo[il] the Beauty of the Colour, an[d] make it faint; therefore th[e] best Way to lay it on, is b[y] *Strewing*, and then there is n[o] a more glorious Colour in th[e] World.

he Manner of ſtrewing Smalt.

Firſt, Temper up white Lead etty ſtiff, with good clear dry- Oil; let it be as ſtiff as it ll can be to ſpend well from the ncil; cover over the Super- ies of the Work that you in- d to ſtrew Smalt upon with s white Colour, and if it be Margin of a Dial, whoſe gures are already gilt with ld, let every Part between Figures, and where there is Gold laid on, be done over, d be very exact in the Work; the Smalt takes no where but this new and moiſt Ground.

Lay the Work that is to be ne over with ſtrew'd Smalt , and ſtrew it thin on the ing to be coloured, and oke over it with the Feather ge of a Gooſe Quill, that it may even and alike thick in all ces: when this has been done, it down cloſe with a bunch ſoft pliable Linen-cloth, that may take well upon the ound to be thoroughly dry; n wipe off the looſe Colour h a Feather, and blow the mainder of it off with a pair Bellows, and the Work is h'd.

This is the Method for Colour- any kind of Work with Smalt trewing, provided the Work ſuch as requires only the n Colour.

ut in Caſe you are to Paint kind of Body with Smalt, h requires Shadow for the perfect Reſemblance; as oſe it to be a blue Bell or ue Boar, *&c.* in this Caſe, n you have drawn out the perfect Symmetry of the Shape you intend, and have covered it with a Ground of white Lead, well and ſtiffly tempered with clear and fat Linſeed Oil, then give it the neceſſary Shadows with good black well tempered; and when you have finiſh'd theſe Shadows, afterwards ſtrew on the *Smalt* as before directed; and when the whole is dry, and the ſuperfluous Part be taken away, the Work will appear with all its Shadows, as exact as poſſible.

Note, That the Work upon which you lay on this Ground, that is to be ſtrew'd with Smalt, ought to be firſt ſufficiently prim'd, and laid alſo over once with White, before the Ground is laid on, that you may be ſure that the Ground is perfectly White; for a white Ground is the only thing that gives the Beauty and Glory to the Colour of the Smalt.

In all other Caſes where the Work to be ſtrew'd over with Smalt does not lie flat, you muſt take your Smalt upon a flat Bunch of Linnen-cloth, and ſo dab it upon the Ground you are to lay it upon.

Note, That there are 2 Sorts of Smalt, the one much finer than the other; but the coarſeſt gives the moſt glorious Colour of all, if look't on at a Diſtance; for near the Eye the Beauty is not ſo great; the fineſt is that which is call'd *Oil Smalt*, which is ground with white Lead, and may be laid in Oil; but does not bear a good Body, nor does it work but with much Difficulty.

SMITHS *Work* [in Relation to *Architecture*] is of divers Kinds, as making Casements, Pallisade Work in Gates or otherwise, Dogs, Bars, large Hooks, Hinges, Staples, *&c.* for which they have in some Places 3 ½*d*, in others 4 *d. per* Pound; but for small and neat Hook Hinges, Staples, *&c.* they hav from 4*d* to 8*d per* Pound. F Iron Balconies, 5*d per* Pound.

Of *making a Smith*'s Bil This should be done after t following Manner.

Mr. *Thomas Anderson*, his Bill of Materials had of, an Work done by *John Smith*; 1733.

	l.	*s.*	
Jan. 16. For 4 large Casements, weighing 40 *l.* at 6 *d. per l.* - - - - - - - - - - - -	1	00	
Feb. 6. For 5 small Casements, weighing 30 *l.* at 6 *d. per l.* - - - - - - - - - - - -	0	15	
------12. For 12 Pair of Hooks and Riders for Doors, weighing 65 *l.* at 4 *d. per l.* - - -	1	01	
March 17. For three great Bars for Chimneys, weighing 60 *l.* at 4 *d. per l.* - - - - - -	1	00	
April 14. For 4 Door Bars, weighing 40 *l.*, at 4 *d. per l.* - - - - - - - - - - - -	0	13	
------- 25. For 4 Dogs, weighing 24 *l.* at 4 *d. per l.* -	0	08	
May 12. For 4 large Bolts, for Doors, weighing 6 *l.* at 4 *d. per l.* - - - - - - -	0	02	
	5	00	

SOCLE } [in *Architecture*] ZOCLE } a flat square Member under the Bases of Pedestals of Statues, Vases, *&c.* which it serves as a Foot or Stand.

SOFFIT } [in *Architecture*] SOFFITO } is any Plafond or Ceiling form'd of cross Beams or flying Cornices, the square Compartiments or Pannels of which are inriched with Sculpture, Painting or Gilding. As those are which are to be seen in the Palaces of *Italy*, in the Apartments of *Luxembourg* at *Paris*, &c.

The Sofites of Arches, says a modern Author, if they are divided into Pannels, they must be of an uneven Number, having a Pannel in the Midd The Border must be no m than one Sixth, nor less t one Seventh of the whole Bread

SOFFIT } is particul SOFFITO } used for under Side or Face of an chitrave; and for that of *Corona* or *Larmier*, which call Plafond, and the an *Roman* Architects, *Lacunar*

It is inrich'd with Comp ments of Roses; and has Drops in the *Dorick* O disposed in 3 Ranks, 6 in e placed to the Right Hand o Guttæ, and at the Botto the Triglyphs.

SOILS. See SELLS.

SOLDER } [in *Architec-*
SODDER } *ture*] is a me-
llick or mineral Compoſition, ſed in Soldering or Joining to-ther other Metals.

Solders are made of Gold, lver, Tin, Copper, Glaſs of in and Lead; and it is to be bſerved, that in the Compoſi-on, there muſt be ſome of the etal to be ſoldered.

There are ſeveral kinds of lder, but that which more mediately relates to our pre-nt Buſineſs, is Solder for Lead, ed by Plumbers.

This is made of two Pounds Lead to one of Tin: but *Glaziers* Uſe it may be ade ſomething finer.

As to the Price. Solder is d from 8 *d.* to 10 *d.* a Pound, cording to its Fineneſs.

The Goodneſs of Solder is ed by Melting it, and pour-the Bigneſs of a Crown-ce upon a Table; for if d, there will ariſe little bright ning Stars therein.

To know if Solder be fine e-gh for *Glazier*'s Uſe: Some ect to take a Piece of it and d it to and fro near their r; for if it be of a fit Tem-, it will crackle like Nits.

SOLID [in *Geometry*] is the rd Species of Magnitude, ing three Dimenſions, *viz.* ngth, Breadth, and Thick-, and is frequently uſed the ſame Senſe with Body.

t may be conceiv'd to be n'd by the direct Motion, Revolution of any Superfi-, of what Nature or Figure er.

A Solid is terminated or contain'd under one or more Planes and Surfaces; as a Surface is under one or more Lines.

Regular SOLIDS, are thoſe terminated by Regular and equal Planes: under this Claſs come the *Tetrahedron*, *Hexahedron* or *Cube*, *Octahedron*, *Dodecahedron*, *Icoſihedron*.

Irregular SOLIDS are all ſuch as do not come under the Definition of *Regular Solids*; ſuch are the *Sphere*, *Cylinder*, *Cone*, *Parallelogram*, *Priſm*, *Parallelopiped*, &c.

SOLID *Angle*, is an Angle made by the meeting of three or more Planes, and thoſe joining in a Point, like the Point of a Diamond well cut.

SOLID *Numbers*, are thoſe which ariſe from the Multiplication of a Plane Number by any other whatſoever, as 18 is a Solid Number made by 6, (which is Plane) multiply'd by 3; or of 9, multiply'd by 2.

SOLID *Problem* [in *Mathematicks*] is one which cannot be Geometrically ſolv'd, but by the Interſection of a Circle and a Conick Section; or by the Interſection of two other Conic Sections beſides the Circle.

SOLIDITY, is a Quality of a natural Body, contrary to Fluidity, and appears to conſiſt in the Parts of the Bodies being interwoven and entangled one with another, ſo that they cannot diffuſe themſelves ſeveral Ways, as Fluid Bodies can. Or it is the Quantity of Space contain'd in a Solid Body; call'd alſo the *Solid Content* and the Cube thereof.

SOLIDITY [in *Architecture*] is apply'd both to the Consistence of the Ground, wherein the Foundation of a Building is laid, and to a Massive in Masonry of extraordinary Thickness, without any Cavity within.

SOLIVE [in *Carpentry*] signifies a Joist or Rafter, or Piece of Wood, either slit or saw'd, wherewith the Builders lay their Ceilings.

These are made of different Thicknesses, according as their Lengths require, and their Distances from each other, are usually equal to their Depths.

SOLUTION [in *Geometry*, &c.] is the answering of any Question, or the Resolution of any Problem.

SOMMERING. See *Arches*.

SPHERE [in *Geometry*] a Solid Body contain'd under one single Surface, and having a Point in the middle, call'd the Centre, whence all the Lines drawn to the Centre are equal.

The Sphere is suppos'd to be generated by the Revolution of a Semi-circle about its Diameter, which is also call'd the *Axis of the Sphere*; and the Extreme Points of the Axis, the *Poles of the Sphere*.

The Properties of the Sphere.

1. A Sphere is equal to a Pyramid, whose Base is equal to the Surface, and its Height to the Radius of the Sphere.

Hence a Sphere being esteem'd such a Pyramid, its Cube or Solid Content is found like that of a Pyramid.

2. A Sphere is to a Cyli[nd]der, standing on an equal B[a]sis, and of the same Height [as] 2 to 3. Hence also may th[e] Cube or Content of the Sphe[re] be found.

3. The Cube of the Diame[e]ter of a Sphere, is to the S[o]lid Content of the Sphere, nea[r]ly as 300 to 157: and thus al[so] may the Content of the Sphe[re] be measured.

4. The Surface of a Spher[e] is Quadruple to that of a Circ[le] describ'd with the Radius of [the] Sphere. For since a Sphere [is] equal to a Pyramid, who[se] Base is the Surface, and i[ts] Altitude the Radius of th[e] Sphere: the Surface of th[e] Sphere is had, by dividing i[ts] Solidity, by a third Part of i[ts] Semi-Diameter.

If now the Diameter of th[e] Circle be 100, the Area will b[e] 7850; consequently the Soli[-] dity 1570000, which divide[d] by a third of the Semi Diame[-] ter 100, the Quotient will be th[e] Surface of the Sphere, 3140[0] which is manifestly the Qu[a]druple the Area of the Circl[e].

The Diameter of a SPHER[E] being given, to find its Surfac[e] and Solidity;

Find the Periphery of th[e] Circle, describ'd by the R[a]dius of the Sphere.

Multiply (this being foun[d]) into the Diameter; the Pr[o]duct is the Surface of t[he] Sphere: Multiply the Surfa[ce] by the sixth Part of the Di[a]meter, and the Product will [be] the Solidity of the Sphere.

Thus supposing the Diam[e]ter of the Sphere, 56, the P[e]riphe

phery will be found 175; hich multiply'd by the Diameter, the Product 9800 is the rface of the Sphere, which ultiply'd by one sixth Part of e Diameter, gives the Solidity 919057, or thus;

Find the Cube of the Diameter 175616: then to 300157, d the Cube found, find a rth Proportional 919057, and is will be the Solidity of the here.

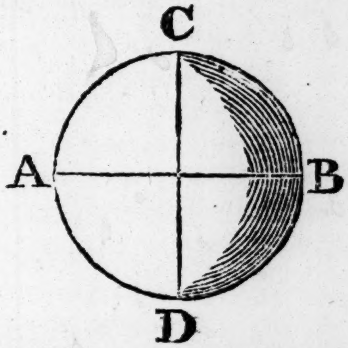
Or thus,

1. Multiply the Axis or Diameter into the Circumference, d the Product will be the perficial Content; which ltiply by the sixth Part of e Axis, and the Product will the Solidity.

2. Or thus,: as 21 is to 11; is the Cube of the Axis to e Solid Content.

3. Or as 1. is to .5236, so is e Cube of the Axis to the solid Content.

Example. Let A B C D be a obe, whose Axis is 20 Inches, then the Circumference l be 62.832: then by the t Rule multiply the Circumference by the Axis, and the duct will be 1256.64, which he Superficial Content in Ins: take a fixth Part thereof, ich is 209.44 (because an ct sixth Part of 20 cannot be taken) multiply that sixth Part by 20 (the Axis) and the Product will be 4188.8 the Solidity in Inches.



Or if you multiply the Superficial Content by the Axis, and take a sixth Part of the Product, the Answer will be the same.

Or thus by the second Rule.

The Cube of the Axis is 8000, which multiply'd by 11, the Product will be 88000, which being divided by 21, the Quotient will be 4190.47, the Solidity.

Or by the third Rule.

If the Cube of the Axis be multiply'd by 5236, the Product will be 4188.8, the Solidity, the same as by the first Way. If you divide 4188.8 by 1728, the Quotient will be 2.424 Feet. See the Work.

62.832
20

6)1256.640 the Superficial Content.

209.44 a sixth Part.
20

4188.80 the Solidity in Inches.

21. : 11 : : 8000
11

21)88000(4190.47 the Content.

40
190
100
160

13

1 : .5236 : : 8000
8000

1728)4188.8000(2.424 Feet, the Solidity.

Note, If the Axis of a Globe be 1. the Solidity will be .5236; and if the Circumference be 1. the Solidity will be .016887.

By Scale and Compasses.

Extend the Compasses from 1 to 20 (the Axis) that Extent (turn'd three times over from .5236) will at last fall upon 4188.8 the Solid Content in Inches: or extend the Compasses from 1728 to 8000 (the Cube of the Axis) and that Extent will reach from .5236 to 2.424, the Solid Content in Feet.

Extend the Compasses from 1 to 20 (the Axis) and that Extent (turn'd twice over from 3.1416) will at last fall upon 1256.64, the Superficial Content in Inches; or extend the Compasses from 144 to 400 (the Square of the Axis) and that Extent will reach from 3.1416 to 8.72, the Superficial Content in Feet.

Demonstration.

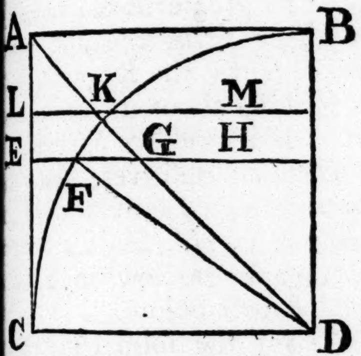
Every Sphere is equal to Cone, whose perpendicular Ax is the Radius of the Spher and its Base a Plane equal all the Surface of it.

For you may conceive t *Sphere* to consist of an infini Number of Cones, whose Ba taken all together, compose t Surface, and whose Vertex meet all together in the Cent of the *Sphere*: Hence the S lidity of the Sphere will gain'd by multiplying its Su face by $\frac{1}{3}$ of its Radius.

Let the Square A B C D, t Quadrant C B D, and the Rig angled Triangle A B D be su pos'd all three to revolve rou the Line B D, as an Axis; th will the Square generate a C linder; the Quadrant an H misphere, and the Triangle Cone, all of the same Ba and Altitude.

Then the Square of E ($= \square$ F D) $= \square$ F H-

DH (but DH $=$ GH) d since Circles are as the uares of their Diameters. y *Euclid* 12. 2.) the Circle ade by the Revolution of H, must be equal to both e Circles made by the Mo- on of F H, and G H.



If you take the Circle made y the Revolution of F H from oth, there will remain the ircle made by the Motion of H, equal to the Ring de- rib'd by the Motion of E F, d thus it will always be, herever you draw the Line H or l M, &c.

Therefore the Aggregate or um of all the Rings, made y the Revolution of the E F's ust be equal to that of all e Circles, made by the Mo- on of the G H's, *i.e.* the Dish- ke Solid, form'd by the re- lving Rings; will be equal to e Cone, form'd by the Re- lution of G H's, which are e Elements of the Triangle B D; that is the Dish-like olid will be as the Cone $\frac{1}{3}$ of e circumscribing Cylinder, d consequently the Hemi- here must be $\frac{2}{3}$ of it: where- re the Sphere is $\frac{2}{3}$ of the rcumscribing Cylinder.

Let the Radius of the Sphere be $r = CD$, then the Diameter will be $2r$: let the Surface of the Sphere generated by the revolving Semi-circle, be call'd S, and that of the Cylinder form'd by the Revolution of $2AC = 2r =$ Diameter, be call'd $\int$. wherefore, in what was just now prov'd, the Expression for the Solidity of the Sphere in this Notation will be $\frac{1\,rS}{3}$, and putting c equal to the Circumference of the Base, or for the Periphery of a great Circle of the Sphere, the curve Surface of the Cylinder will be $2\,r\,c$; also $\frac{r\,c}{2}$ will be the Area of a great Circle; and this multiply'd by $2\,r$, makes $r\,r\,c$, which is the Solidity of the Cylinder. Now since $\int$ was put $=$ to $2\,r\,c =$ the Curve Surface of the Cylinder $\frac{\int r}{2}$ (by substituting $\int$ for $2\,r\,c$) will be also $=$ the Solidity of the Cylinder. Now since the Sphere is $= \frac{2}{3}$ of the Cylinder, $\frac{r\,S}{3} = \frac{2}{3}\ \frac{\int r}{2}$; that is, $\frac{r\,S}{3} = \frac{2\int r}{6} = \frac{\int r}{3}$ wherefore $r\,S = r\int$, that is, dividing by r, $S = \int$, or the Surface of the Sphere is equal to the Curve-Surface of the Cylinder; but the Curve Surface of the Cylinder was $2\,r\,c$.

Wherefore to find the Area of the Surface of either Sphere or Cylinder, you must multiply the Diameter ($= 2\,r$) by the

the Circumference of a great Circle of the Sphere, or by the Periphery of the Base.

From this Notation also $\frac{rc}{2}$ the Area of a great Circle of the Sphere is plainly $\frac{1}{4}$ of $2rc$, the Surface of the Sphere; that is, the Surface of the Sphere is Quadruple of the Area of the greatest Circle of it.

Wherefore to $2rc$, the Convex Surface of the Cylinder, add rc, equal to the Area of both its Bases, you will have $3rc$; which shews you, that the Surface of the Cylinder (including its Bases) is to the Surface of the Sphere as 3 to 2; or that the Sphere is $\frac{2}{3}$ of the circumscribing Cylinder, in Area as well as Solidity.

SPHERICAL, of or belonging to a Sphere.

SPHERICAL *Geometry*, is the Doctrine of the Sphere; particularly of the Circles describ'd on the Surface thereof, with the Method of Projecting the same upon a Plane.

SPHERICAL *Trigonometry*, is the Art of Resolving Spherical Triangles, *i. e.* from three Parts of a *Spherical* Triangle given, to find the rest.

SPHERICITY, the Quality of a Sphere, or that whereby a Thing becomes spherical or round.

SPHERICKS, *the Doctrine of the Sphere*, particularly of the several Circles describ'd on the Surface thereof, with the Method of projecting the same on Planes.

SPHEROID [in *Geometry*] is a Solid approaching to the Figure of a Sphere; but n[ot] exactly round, but oblong; [a]s having one of its Diamete[rs] bigger than the other; and ge-nerated by the Revolution of [a] Semi-Ellipsis about its Axis.

When it is generated by th[e] Revolution of a Semi-Ellips[is] about its greater Axis, 'tis call['d] an *oblong Spheroid*; and whe[n] generated by the Revolution o[f] an Ellipsis about its lesser Axi[s], it is call'd an *oblate Spheroid*.

Daviler observes, that th[e] Contour of a Dome should b[e] half a *Spheroid*. Half a Spher[e] he says is too low to have [a] good Effect below.

As for the solid Dimension of a *Spheroid*, it is $\frac{2}{3}$ of its circumscribing Cylinder; or it i[s] equal to a Cone, whose Altitude is equal to the greate[r] Axis, and the Diameter of th[e] Base, to four times the lesse[r] Axis of the generating Ellipsi[s].

Or a Spheroid is a Spher[e] describ'd on its greater Axis, [as] the Square of the lesser Axi[s] to the Square of the greater; or 'tis to a Sphere describ'd o[n] the lesser Axis, as the greate[r] Axis to the less.

To find the Solid Content of [a] Spheroid.

Multiply the Square of th[e] Diameter of the greatest Ci[r]cle by the Length, and th[at] Product multiply again b[y] .5236; this last Product will b[e] the Solidity of the Spheroid.

Let A B the Diameter of th[e] greatest be 33 Inches, and C [D] (the Length) 55 Inches; th[e] Solidity is required.

33
33
———
99
99
———
1089
55
———
5445
5445
———
59895

Demonstration.

Every Spheroid is equal to of a Cylinder, whose Base is ual to the greatest Circle of e Spheroid, and its Height ual to the Length of the heroid.

Suppose the Figure N T, N, in the annexed Scheme, represent a Spheroid, form'd the Rotation of the Semi-llipsis T N S, about its transverse Axis T S.

Let D = T S, the Length the Spheroid, and the Axis its circumscribing Sphere, d $d =$ N n, the Diameter of e greatest Circle of the Sphe-id.

SPIRA } [in the ancient *Ar-*
SPIRE } *chitecture*] is some-mes us'd for the Base of a Co-mn, and sometimes for the *stragal* or *Tore*.

SPIRAL [in *Geometry*] is a urve of the Circular Kind, hich in its Progress recedes om its Centre, as in winding om the Vertex down to the ase of a Cone.

59895
15236
———
359370
179685
119790
299475
———
31361.0220 Solidity.

SPIRAL [in *Architecture*, &c.] is a Curve which ascends, winding about a Cone or Spire; so that all the Points of it continually approach the Axis; by this it is distinguish'd from the *Helix*, which winds after the same Manner round a Cylinder.

SPLAYING of Windows and Doors. See *Bricklayers*.

SPRINGS for Casements of the common or ordinary Fashion are made for about 6 *d.* *per* Piece.

SQUARE [in *Geometry*] is a Quadrilateral Figure; both equilateral and equiangular; or

A SQUARE is a Geometrical Figure, having four equal Sides, and as many Right (or Square) Angles.

To find the Superficial Content.

Multiply the Side into it self, and the Product is the Content.

Let A B C D be a Geometrical Square given, each Side being 14 Feet, Yards or other Mea-

Meaſure; multiply 14 by it ſelf, and the Product is 196, which is the Superficial Content. See the *Plate*. *Fig*. 5.

$$\begin{array}{r} 14 \\ 14 \\ \hline 56 \\ 14 \\ \hline 196 \end{array}$$

By Scale and Compaſſes.

Extend the Compaſſes from 1 on the Line of Numbers to 14; the ſame Extent will reach from the ſame Point turn'd forward to 196.

Demonſtration.

Let each Side of the given Square be divided into 14 equal Parts, and Lines drawn from one another croſſing each other within the Square; ſo ſhall the whole Square be divided into 196 little Squares, as is to be ſeen in the Figure annexed, equal to the Number of ſquare Feet, Yards or other Meaſures, by which the Side is meaſured.

The Properties of a Square are, that its Angles are all right, and conſequently its Sides perpendicular; that it is divided into two equal Parts by a Diagonal; that the Diagonal of a Square is incommenſurable to its Side.

A Geometrical SQUARE is a plain Figure contain'd under four equal Right Lines, as A B C D, whoſe Angles at A B C D are each Right Angles, in which obſerve, that the Lines A D and C B are the Diagonals; the Lines E H and F G the Diameters, and the Point where they all interſect, is the Centre. See *Plate*, *Fig*. 6.

To deſcribe the Geometrical SQUARE A D E F, whoſe ſeveral Sides ſhall be equal to the given Line E G F;

Firſt. Make E F = G H and on F erect the Perpendicular F D = to G H. Then on the Points E and D, with the Diſtance G H, deſcribe the Arches C C and B B. See *Plate*, *Fig*. 7.

Secondly, Join A E and A D and they compleat the Geometrical Square A D E F, as required.

SQUARE, an Inſtrument of Braſs or Wood, having one Side perpendicular or at Right Angles to the other, ſometimes made with a Joint to fold for the Pocket; and ſometimes has a Back to uſe on a Drawing Board, to guide the Square.

SQUARE *Number* is the Product of a Number multiply'd by it ſelf: thus 4 is the Product of 2, multiply'd by 2, or 16 the Product of 4, multiply'd by 4, are Square Numbers.

SQUARE *Root*, a Number conſidered as the Root of a ſecond Power or ſquare Number, or a Number by whoſe Multiplication into it ſelf, a ſquare Number is generated.

Thus the Number 2, being that by whoſe Multiplication into it ſelf, the ſquare Number 4 is produc'd, is in Reſpect here-

ereof call'd a Square Root, or e Square Root of 4.

Geometrical SQUARE, is a ompartment frequently added the Face of the Quadrant, ll'd alſo a *Line of Shadows*, d *Quadrant*.

Extraction of the SQUARE ROOT.

If a ſquare Number be given; find the Root thereof, at is, to find out ſuch a Number, as being multiply'd into ſelf, the Product ſhall be ual to the Number given, ch Operation is call'd, *The Extraction of the Square Root*; hich to do, obſerve the folwing Directions.

1ſt. You muſt point your gin Number, that is, make a oint or Prick over the Unit's lace, another upon the Hunred's, and ſo upon every ſecond igure throughout.

dly, Then ſeek the greateſt ſquare Number in the firſt Point towards the left Hand, placing the ſquare Number under the firſt Point, and the Root thereof in the Quotient, and ſubtract the ſaid ſquare Number from the firſt Point and to the Remainder bring down the next Point, and call that the Reſolvend.

3dly, Then double the Quotient, and place it, for a Diviſor, on the left Hand of the Reſolvend; and ſeek how often the Diviſor is contain'd in the Reſolvend (reſerving always the Unit's Place) and put the Anſwer in the Quotient, and alſo on the Right-hand Side of the Diviſor; then multiply by the Figure laſt put in the Quotient, and ſubtract the Product from the Reſolvend, (as in common Diviſion) and bring down the next Point to the Remainder (if there be any more) and proceed as before.

A Table *of Squares and Cubes, and their Roots.*

Root	1	2	3	4	5	6	7	8	9
Squa.	1	4	9	16	25	36	49	64	81
Cub.	1	8	27	64	125	216	343	512	729

Example 1. Let 4489 be a umber given, and let the uare Root thereof be requir'd.

4489 (67
36

127)889 Reſolvend.
889 Product.

Firſt, Point the given Number, as before directed; then (by the little Table aforegoing) ſeek the greateſt ſquare Number in 44 (the firſt Point to the left Hand) which you will find to be 36, and 6 the Root; put 36 under 44, and 6 in the Quotient, and ſubſtract 36 from 44, and

and there remains 8. Then to that 8 bring down the other Point 89, placing it on the right Hand, ſo it makes 889 for a Reſolvend; then double the Quotient 6, and it makes 12, which place on the left Hand for a Diviſor, and ſeek how often 12 in 88, (reſerving the Units Place) the Anſwer is 7 times; which put in the Quotient, and alſo on the Right Hand Side of the Diviſor, and multiply 127 by 7, (as in common Diviſion) and the Product is 889, which ſubtracted from the Reſolvend, there remains nothing; ſo is your Work finiſh'd; and the ſquare Root of 4489 is 67; which Root if you multiply by it ſelf, that is, 67 by 67, the Product will be 4489, equal to the given ſquare Number, and proves the Work to be right.

Example 2. Let 106929 be a Number given, and let the ſquare Root thereof be requir'd.

. . . .
106929(327
9

62)169 Reſolvend.
124 Product.

647)4529 Reſolv.
4529 Product.

. . . .

Firſt, Point your given Number, as before directed, putting

a Point upon the Units, Hu
dreds, and Tens of Thou
ſands: then ſeek what is th
greateſt ſquare Number in 1
(the firſt Point) which by th
little Table you will find to b
9, and 3 the Root thereof; pu
9 under 10, and 3 in the Quo
tient; then ſubſtract 9 out o
10, and there remains 1; t
which bring down 69, the nex
Point, and it makes 169 fo
the Reſolvend; then doubl
the Quotient 3, and it makes 6
which place on the left Han
of the Reſolvend for a Diviſo
and ſeek how often 6 in 16
the Anſwer is twice; put 2 i
the Quotient, and alſo on th
Right Hand of the Diviſo
making it 62. Then multip
62 by the 2 you put in th
Quotient, and the Product
124; which ſubſtract from th
Reſolvend, and there remai
45; to which bring down 29
the next Point, and it make
4529 for a new Reſolven
Then double the Quotient 3
and it makes 64, which plac
on the left Side the Reſolven
for a Diviſor, and ſeek how o
64 in 452, which you will fin
7 times; put 7 in the Quo
tient, and alſo on the righ
Hand of the Diviſor, makin
it 647, which multiply'd by th
7 in the Quotient makes 452
which ſubſtracted from the Re
ſolvend, there remains nothing
So 327 is the ſquare Root o
the given Number.

Example 3. Let 2268741 b
a ſquare Number given, th
Root whereof is requir'd.

2268741

```
   . . . .
 2268741)1506.23
 1
 —
5)126
 125
 —
3006)18741
   18036
   —
30122)70500
    60244
    —
01243)1025600
    .903729
    —
mains .121871
```

Having pointed the given mber, as before directed, k what is the greatest square mber in the first Point 2, ich is one; put 1, the Square der 2, and 1, the Root there- in the Quotient; subtract rom 2, and there remains 1; which bring down the next int, 26, and set it on the ht Hand, making it 126; ble the 1 in the Quotient, ich makes 2; set 2 on the Hand for a Divisor, and ask w often 2 in 12, which will 5 times; put 5 in the Quo- t, and also on the right nd of the Divisor, making 5; multiply (as in common ision) 25 by 5, and subtract Product, 125 from 126, and re remains 1. Bring down next Point, 87, and it kes 187 for a new Resolvend; and double the 15 in the Quotient, it makes 30 for a new Divisor. Then seek how often 30 in 18, which you can't have; so that you must put 0 in the Quotient, and also on the right Hand of the Divisor, and bring down the next Point, and it makes 18741 for another new Resolvend. Then seek how often 300 in 1874, which will be 6 times; put 6 in the Quotient, and also on the right Hand of the Divisor, multiply and subtract, and the Remainder will be 705. Now, if you have a Mind to find the Value of the Remainder, you may annex Cyphers, by two at a Time, to the Remainders, and so prosecute the Work to what Number of decimal Parts you please; thus, to 705 annex two Cyphers, and it will make 70500 and the Quotient, doubled, is 3012 for a Divisor: Then seek how often 3012 in 7050 (rejecting the Unit's Place) which will be twice; put 2 in the Quotient, and also on the right Hand of the Divisor, and multiply and substract as before, and the Remainder will be 10256; to which annex two Cyphers, and proceed as before, and you will get a 3 in the Quotient next. So the square Root of the given Number is 1506.23, which being squar'd, or multiply'd, by it self, and the last Remainder added, will make the given Number, as follows.

1506.23

```
                 1506.23
                 1506.23
                 -------
                 451869
                301246
               903738
              753115
             150623
             ------------
             2268728.8129
The Remainder add —— 12.1817
             ------------
       Proof 2268741.0000
```

Some more Examples for Practice.

```
              . . . .
Example 1. 7596796 (2756.228 Root.
           4
          ---
       47) 359
           329
          -----
      545) 3067
           2725
          ------
     5506) 34296
           33036
          -------
    55122) 126000
           110244
          --------
   551242) 1575600
           1102484
          ---------
  5512448) 47311600
           44099584
          ----------
            3212016
```

Example 2. 751417.5745 (866.4 Root.

64

166) 1114
996

1726) 11817
10356

17328) 146157
138624

173364) 753345
693456

59889

If the given Number be a ix'd Number, *viz.* consisting f a whole Number and a Demal together, make the Numer of decimal Places even, at is, 2, 4, 6, 8, &c. that so ere may a Point fall upon the Unit's Place of the whole Numbers, as in this last Example, and in that following.

Example 3. Let 656714.37512 be given, to find the square Root.

656714.375120 (8103.79 Root.

64

161) 167
161

16203) 61437
48609

162067) 1282851
1134469

1620749) 14838220
14586741

Remains 251479

In this Example there are five Places of Decimals; therefore put a Cypher to it, to make it even, that so there, may a Point fall upon 4 the Unit's Place.

To find the Square Root of a Fraction.

If it be a decimal Fraction, the Work differs nothing from the Examples afore-going, only you must be mindful to point your given Number aright, for (as was before directed) the Number of Places must always be made even, and then begin to point at the right Hand, as in whole Numbers.

If it be a vulgar Fraction, it must be reduc'd to a Decimal.

I shall give an Example or two in each Case, and so conclude.

Let .125 be a decimal Fraction given, whose square Root is requir'd; and let it be requir'd to have four Places of Decimals in the Root.

```
        .  .  .  .
     .12500000(.3535
      9
     ----
 65)350
    325
    ----
703)2500
    2109
    -----
7065)39100
     35325
     -----
      3775
```

In this Example there must be five Cyphers annex'd, because two Places in the Square make but one in the Root.

Let the Square Root of .00715 be requir'd.

```
   .007150(.084
     64
     ---
164)750
    656
    ---
     94
```

In this a Cypher is added to make the Places even.

Let $\frac{7}{8}$ be a vulgar Fraction given, whose square Root is requir'd.

```
8)7000            .  .  .  .
  64          (.87500000(.935
  --            81
  60            ---
  56         183)650
  --             549
  40             ---
  40        1865)10100
  --              9325
  ..              -----
           18704)77500
                 74816
                 -----
                  2684
```

Reduce this $\frac{7}{8}$ to a Decimal, makes 875; to which annex yphers, and extract the ſquare oot, as if it was a whole Number. So the Root is .935.4

Let $\frac{3}{960}$ be a vulgar Fraction, whoſe ſquare Root is requir'd.

96|0)3.0000000|0
....
288

120
96

240
192

480
480

...

.... Root.
(.00312500(.0559.
25

105)625
525

1109)10000
9981

19

In extracting the Root of s, becauſe the firſt Point cons of Cyphers, there muſt be Cypher put firſt in the Quont.

To prove this Rule, ſquare Root, and to the Product the Remainder, as was ore directed. To ſquare a mber, is to multiply it by ſelf; and to cube it, is to ltiply the Square of the mber, by the Number it .

QUARING [with *Mathe-icians*] ſignifies the making quare equal to a Circle. us the Quadrature or ſquaof the Circle, is the finda Square equal to the Area a Circle.

TABLE, a Building whereorſes are kept: It ſhould lac'd in a good Air, made of Brick, and not of Stone, the firſt being moſt wholeſom and warmeſt; for Stone will ſweat upon the Alteration of the Weather, which begets Damps and cauſes Rheums in Horſes, neither ſhould there be any unſavoury Gutter, Sink, Jakes, Hog-Sties or Hen-Rooſt near it.

The Rack ſhould be plac'd neither too high nor too low, and ſo well poſited, that the Hay-Duſt fall not into his Neck, Face or Mane: the Manger ought to be of an indifferent Height, made deep, and of one intire Piece, as well for Strength as Conveniency, and the Floor muſt be pav'd and not plank'd, which is liable to a great many Inconveniencies; nor ſhould there be any Mud or Loam Wall near it, for the Horſe will

eat it, and that will make him ſick, Loam and Lime being ſuffocating Things, which will infect and putrify the Blood, endanger the Lungs, and ſo ſpoil his Wind.

There ſhould alſo, if Conveniency will permit, be Space in the Stable for a Bed for Servants to lie in; and in the Nook or Corner a great Rack, on which to hang Halters, Saddles, and other Utenſils.

STAIRS [in *Building*] are the Steps whereby we aſcend and deſcend, from one Story of an Houſe to another.

As to the Dimenſions of *Stairs*, they are differently aſſign'd by different Authors; but however, they agree in this, that they muſt not be more than ſix, nor leſs than four Inches high; nor more than 18, nor leſs than 12 Inches broad; nor more than 16, nor leſs than ſix Foot long each Stair.

But theſe Meaſures have only Reſpect to large and ſumptuous Buildings; for in common and ordinary Houſes, they may be ſomething higher and narrower, and much ſhorter; yet even in theſe, the Stairs are not to exceed ſeven, or (at moſt) eight Inches in Height; for if they do, they will be difficult to aſcend: neither ought they to be leſs than nine or ten Inches in Breadth, nor ought their Length to be leſs than three.

To reduce the Dimenſions of Stairs to ſome natural, or at leaſt Geometrical Standard, *Vitruvius* borrows the Proportions of the Sides of a Rec angle Triangle, which the an cient School expreſs'd by th Numbers 3, 4 and 5; that i three for the Perpendicul from the *Stair Head* to th Ground; 4 for the *Groun Line* it ſelf, or Receſſion fro the Wall (ſays Sir *Henry Wo ton)* and the fifth for the who Slope and Inclination, from th Edge of one Stair to that another.

But this Rule is ſet aſide modern Builders, and that wi good Reaſon; for on this Pri ciple, the lower the Stairs, t narrower they muſt be; a for Inſtance, Stairs four Inch high (ſuch as are found me tioned in ancient Architec muſt be but $5\frac{1}{3}$ Inches bro and if a Stair be but ſix Inc high, it muſt be but eight Inc broad, whereas in this Caſe, ſeldom make them leſs tha Foot broad.

One Rule to be regarded making of Stairs, is that t be laid according to the *lian* Phraſe, *con un tan de ſcarpa*; i. e. *ſomewhat f ing*, or a little higher behi that the Foot, may as it we both aſcend and deſcend at ſame time; which tho' it is ſerv'd but by few, is found be a ſecret and delicate Dec tion of the Pains in aſcendin

Of making Stairs] Tho' th have been Rules laid down the Height and Breadth Stairs; yet Workmen are to be ſo ſtrictly ty'd up thoſe Rules, as not in the to vary from them; for t muſt always obſerve, to m

the Stairs of the same Stair-
se of an equal Height and
eadth; in Order to which
y must first consider the
ight of the Room, as also
Width or Compass they
e to carry up the Stairs in.
Then in Order to find the
ight of each particular Stair,
y ought first to propose the
ight, and to divide the
ole Height of the Room by
propos'd Height, which be-
done, the Quotient will
w the Number of Stairs;
if the Division does not
out exact, but that there
Remainder; then in this
take the Quotient, (with-
regarding the Remainder)
the Number of Stairs, and
hat Number divide the
e Height of the Room, so
Quotient will give you the
Height of each Stair; as
xample.
ppose the whole Height of
Room to be 9 Foot, 3 In-
and suppose you design'd
ake each Stair 6 Inches
Turn the whole Height
Room into Inches, which
e 111 Inches; divide these
the Quotient will be 18,
remaining; there let the
ber of Stairs be 18, and
ivide 111, and the Quo-
ill be $6\frac{3}{18}$ or $6\frac{1}{6}$ Inches,
must be the exact Height
h Stair.
n to find the Breadth of
Stair, divide the Width
mpass (that you have to
hem up in) by the Num-
Stairs, and the Quotient
ve the exact Breadth of
tair.

STAIR-CASE, is an Ascent inclos'd between Walls, or a Ballustrade, consisting of Stairs or Steps, with Landing Places and Rails; serving to make a Communication between the several Stories of a House, and sometimes it is us'd to signify the whole Frame of a Pair of Stairs only.

The Construction of a compleat Stair-Case, says Sir *Henry Wootton*, is one of the most curious Works in Architecture, and the common Rules are these that follow.

1. That it have a full free Light, to prevent Accidents of slipping, falling, *&c.*

2. That the Space over-head be large and airy, which the *Italians* call *un bel Sfogolo*, i. e. *good Ventillation*, because a Man spends much Breath in mounting.

3. That the half Paces or Landing Places be conveniently distributed for reposing by the Way.

4. That to avoid Rencounters, and also to gratify the Eye of the Beholder, the *Stair Case* be not too narrow; but this last is to be regulated by the Quality of the Building; and that in Royal Buildings, the principal Ascent be at least 10 Foot. For a little Stair Case in a great House, and a great one in a little House, are both equally ridiculous.

5. That great Care be taken in the placing the Stair Case, so that the Stairs may be distributed without Prejudice to the rest of the Building, there being much Nicety requir'd in making this Choice.

The Kinds of Stair Cafes are various; in fome the Stairs are *ftrait*; in others, *winding*; in others, *mixt* of both.

1. *Of ftrait Stairs*, fome fly directly forwards, and are called *Flyers*; others are fquare; others triangular, and others are call'd *French Flights*.

2. *Of winding Stairs*, which are alfo call'd *Spiral* or *Cockle Stairs*, fome are fquare, fome circular, and fome elliptical or *oval*.

And thefe again are various, fome winding round a Solid, and others an open Newel.

Laftly *mix'd Stairs* of ftrait and winding, they are alfo of various Kinds, fome are call'd *Dog-legg'd*, others there are that wind about an open Newel, and fly about a fquare open Newel.

Stair-Cafes being of that Importance in Building, it will be neceffary to give a particular Account of each Kind.

I. *Strait Stairs* are fuch as always *fly*, i. e. proceed in a Right Line, and never wind, and for that Reafon are by fome call'd *Flyers*. Of thefe there are feveral Kinds.

1. *Strait Flyers*, or *Plain Flyers*, which proceed directly from one Floor to another, without turning to the right or left; and are feldom us'd, except for Garret or Cellar Stairs in ordinary Houfes.

2. *Square Flyers*, which fly round the Sides of a fquare Newel, either folid or open; having at every Corner of the Newel a fquare ½ Step, taking up ¼ of a Circle, fo that they fly from one half Pace or Step to another, and the Length the Stairs is perpendicular the Side of the Newel.

3. *Triangular Flyers*, whi fly round by the Sides of a t angular Newel, either folid open, having at each Corn of the Newel a trapezial h Step, taking up ⅔ of a Circl fo they fly from one half S to another, and their Length perpendicular to the Side of Newel.

Palladio tells us, that tri gular Stairs are to be feen fome ancient Edifices, and thefe Sort, he fays, are th of the Cupola of St. *Ma Rotunda*, which are open in middle, and receive Light fr above. Thofe alfo of *Sa Apoftollo* in the fame City, of the fame Kind.

4. *French Flyers*, which firft directly forwards, till t come within the Length o Stair of the Wall, and have a fquare half Space, f which you immediately af to another half Pace, f which you afcend immedia to another half Pace, f which the Stairs fly dire back again, parallel to t firft Flight.

II. *Winding Stairs* are as always wind and neve of thefe alfo there is Variety: for,

Some wind round a Ci others round an Ellipf Oval; others round a Sq and others round an equ ral Triangle: of each of fome wind round a folid N and others, an open or h Newel. Again, fome a

on Columns, and ſome Stairs e double, and ſome quadru-, of each of which I ſhall eak briefly.

1. *Circular winding Stairs*; which there are four Kinds, z. ſuch as wind about a ſolid ewel, the fore-edge of which ing in a Right Line, point- to the Centre of a Newel; mmonly us'd in Church Stee-es and great old Houſes.

Secondly. Such as wind round open Newel, the fore-ſide of ich being in a Right Line, inting to the Centre of the wel, as thoſe in the *Monu-nt* of *London*.

Thirdly. Such as wind round ſolid Newel only, the fore- of each an Arch of a Cir-, either concave or convex, inting near to the Circumfe-rence of the Newel.

In theſe the Stairs are much longer than in the common winding Stairs.

Of theſe there may be two Kinds; for their Ichnography being drawn, the Stairs may be contriv'd to be either Concave or Convex on the foreſide.

Fourthly. There are other Stairs in all Reſpects like thoſe laſt deſcrib'd, only they have an open Newel.

Theſe Kind of Stairs are ſaid to have been invented by *Anthony Barbaro*, a Gentleman of *Venice*.

Any of theſe winding Stairs take up leſs Room than any other kind of Stairs whatſoever.

In Stairs that wind round a ſolid Newel Architects

ake the Diameter of the Newel $\left\{\begin{matrix}\frac{1}{6}\\ \frac{1}{4}\\ \frac{1}{3}\\ \frac{3}{7}\end{matrix}\right\}$ of the Diameter of

whole Stair Caſe; accord- as the Stair-Caſe is in gneſs; for if the Stair-Caſe very ſmall, they make the wel but $\frac{1}{6}$ of its whole Diater; and if very large, then and ſo proportionably of the t.

In Stairs that wind round open Newel, *Palladio* ors the Newel to be $\frac{1}{2}$ the Diameter of the whole Stair-Caſe, tho' then there does not appear any Reaſon why theſe open Newels ought not to be proportion'd to the Size of the Stair-Caſe, as well as the ſolid ones.

Then as to the Number of Stairs in each Revolution, he orders,

hat if the Stair-Caſe be $\left\{\begin{matrix}6 \text{ or } 7\\ 8\\ 9 \text{ or } 10\\ 18\end{matrix}\right\}$ Foot Diameter, then

here may be $\left\{\begin{matrix}12\\ 16\\ 20\\ 24\end{matrix}\right\}$ Stairs in one Revolution about the Newel.

Elliptical winding Stairs. Of these there are two Kinds, the one winding round a Solid, and another round an open Newel. They are much of the same Nature with circular Stairs, except that in those the Newel is a Circle, and in these an Ellipsis or Oval.

These Kinds of Stairs are very handsome and pleasant, (says *Palladio*) because all the Windows and Doors are commodiously plac'd in the middle and Head of the Oval. He tells us he has made one of these with an open Newel, at the Monastery of *Charity* at *Venice.*

Square winding Stairs. These wind round a square Newel, and the fore-side of each Stair is a Right Line, pointing to the Centre of the Newel.

Triangular winding Stairs, are such as wind round a triangular Newel, the fore-side of which being a Right Line, pointing to the Centre of the Newel. And because the Newel may be either solid or open, therefore there are two Kinds of them.

Columniated winding Stairs. *Palladio* mentions a Stair-case in *Pompey's* Portico at *Rome*, set on Columns, so as that the Light they receiv'd from above, might distribute it to all Parts alike: such another Pair were made by *Bramante* (an excellent Architect) at *Belvedere*, the Pope's Palace.

Double winding Stairs. *Scamozzi* mentions a Stair-case of this Form, made by *Piedro del Bergo*, and *Jean Cossin*, at *Sciamberg* in *France*, in the Kin[g's] Palace. They are so contri[ved] that two Persons, the one [as]cending and the other descen[d]ing, shall not meet together [or] come at one another.

Dr. *Grew* describes a Mo[del] of this kind of *Stair-Case*, [in] the *Museum* of the *Royal* [So]*ciety*. The Foot of one of [the] *Stair-Cases*, he says, is oppo[site] to the other, and both mak[e a] parallel Ascent, and within [the] same Cylinder. The Ne[wel] in the middle is hollow, [and] built with long Apertures [to] convey Light from Cand[les] plac'd at the Bottom, and [to] the Sides of the Newel in b[oth] Cases.

Quadruple winding Sta[irs]. *Palladio* mentions a Stair-c[ase] of this Form, which K[ing] *Francis* I. caused to be m[ade] in the Castle of *Chambor*, n[ear] *Bloyse*: it consists of four *St[air]-Cases* carried up together, h[av]ing each its several Entra[nce] and going up one over anot[her] in such Manner, as that b[eing] in the middle of the Build[ing] the four serve for four Ap[art]ments; so that the Peopl[e of] the one need not go up [or] down the Stairs of the ot[her,] yet being open in the mid[dle] they all see each other [and] without any Hindrance to [one] another.

Mix'd STAIRS are suc[h as] partly fly, and partly w[ind,] whence some call them *F[liers]* and *Winders*, of these there [are] several Kinds, as

Dog-legg'd Stairs, which fly directly forwards, [then] wind a Semi-circle, and

directly backwards, parallel that.

Square Flyers and Winders. hese have a square Newel, ther solid or open, and fly by e Sides of the Newel, winding a Quadrant of a Circle at ch Corner.

Solid and open newel'd Flyers d Winders, are of two Kinds; e one winds the Quadrant a Circle about a solid Newel; en flies by the Side of a square en Newel, then winds again the Side of a solid Newel, en flies again as before, and so ernately. The other flies t, then winds, then flies ain alternately.

The Price of Stair-Cases is ious, according to their vaus Kinds, Sizes and Curiosiof Workmanship.

They are sometimes rated o much *per* Piece, and somees at so much *per* Square.

An ordinary Pair of Stairs h Flyers and Winders, of ut 6 Foot and 4 Foot, made Elm Boards, are valued at 6*d.* and 2 *s.* 8 *d. per* Stair; Workmen finding all Mate, as Boards, Nails, *&c.* if the Materials are found the Owner, then 9 *d.* or 10 *d.* Stair is a good Allowance Workmanship.

ut as for Stair-Cases that e an open Newel, with a ding Place at every sixth eighth Stair, being about Foot all the Way; these s with Rails, Ballusters, g-Boards, Posts, Balls, ants, and such other Ornas, may very well be worth *d.* 5 *s.* or 6 *s. per* Stair.

STANCHIONS, the same as *Punchins.*

STATUES, a Figure or Statue rais'd over an Order or Building, says M. *Le Clerc*, may have its Height equal to one third of that Column, or to four ninths of it, if the Statue have no Niches.

If it be bigger, it will make the Building appear little; and if it be less, for Instance only a fourth or little more, the Building will appear by much the larger.

It is observable, adds he, that in Proportion, as a Statue is rais'd above the Eye, it appears to diminish in Bulk; till such time, as being elevated to a very great Pitch, it becomes almost imperceptible.

For this Reason some Architects contend, that the Sculptor must always accommodate his Figures to their Height, and increase their Bigness, just as their Elevation increases, to the End that they may always appear of a reasonable Size.

But as the Orders of Columns are diminish'd in Proportion as they rise over one another, it would happen that the Statues in this Case would become too big for the Order.

An Architect must always proportion his Figures to the Orders, and the Stories where they are to be plac'd; unless it happen to be in a close narrow Place, as in a Stair-Case or Dome, for in that Case, the Orders or the Statues may be enlarged in Proportion. But notwithstanding, Care must be taken not to run into Excess, it

being better that they ſhould appear too little, than too big.

Inſtead of placing Statues to finiſh the uppermoſt Stories, one may have Vaſes, Torches, Pots of Incenſe, Trophies and the like Ornaments; which will ſuit better with ſuch Places than Human Figures; unleſs thoſe repreſent the tutelar Angels, appointed for the Guard and Protection of the Building.

STEEL, is an Iron that is very hard in its Nature, and ſometimes is made ſo by Art; it has the ſame Qualities as Iron.

Some have given Steel the Name of *Chalybs*, becauſe anciently brought from a Town in *Aſſyria*, named *Calibone*, where very good Steel was made; but that of *Damaſcus* is preferr'd before all others, and it is found by Experience, that Swords made of it, cut Iron it ſelf.

Our Way of *Steel-making* is to chuſe ſuch Iron as is apt to melt, and yet hard, and which neverthelefs may be eaſily wrought with the Hammer; for the Iron which is made of Vitriol Ore, tho' it may melt, yet it is ſoft, fragil or eager. Let a Parcel of ſuch Iron be heated red hot, and let it be cut into ſmall Pieces, and then mix'd with that Sort of Stone which eaſily melts, then ſet in the Smith's Forge or Hearth a Crucible, or Diſh of crucible Metal, a Foot and a half broad, and a Foot deep; fill the Diſh with good Charcoal, compaſs the Diſh about with looſe Stones, which may keep in the Mixture of Stones and Pieces of Iron put thereon:

As ſoon as the Coal is th roughly kindled, and the Di is red hot, give the Blaſt, a let the Workman by little a little put in all the Mixtu of Iron and Stone he deſign when it is melted, let hi thruſt into the middle of it, 4, or more Pieces of Iron, a boil them therein five or f Hours, with a ſharp Fire, pu ting in his Rod; ſtir often t melted Iron, that the Pieces Iron may imbibe the ſmall Particles of the melted Iro which Particles conſume a thin the more groſs Particles the Pieces of Iron, and are, it were, a Ferment to the and make them tender.

Let the Workman now ta one of the Pieces out of t Fire, put it under the gre Hammer to be drawn in Bars and wrought, and then h as it is, plunge it immediate into cold Water: being th tempered, let him again wo it upon the Anvil, and bre it, and looking upon the Fra ments, let him conſider wh ther it looks like Iron in a Part of it, or if it be whol condens'd and turn'd into *Ste*

Then let the Pieces be wrought into Bars, which b ing done, give a freſh blaſt the Mixture, adding a lit freſh Matter to it, in the Ro of that which has been i bib'd by the Pieces of Ir which will refreſh and ſtreng en the Remainder, and ma the Pieces of Iron put ag into the Diſh, the purer; ev which Piece, let him, as ſ as it is red hot, beat int

Bar on the Anvil, and cast it hot as it is into cold Water: and thus Iron is made into *Steel*, which is much harder and whiter than Iron.

STEEL-YARD [in *Mechanicks*] is a kind of Balance, call'd *Statera Romana*, or the *Roman Balance*; by Means whereof the Gravity of different Bodies are found by the Use of one single Weight.

It consists of an Iron Beam, A B, wherein a Point is taken at Pleasure, as C, and on this a Perpendicular rais'd C D. On the less Arm A C is hung a Scale or Bason [or else are hung Hooks] as H G to receive the Bodies that are to be weigh'd.

The Weight *I* is shifted this Way and that Way on the Beam, till it is a Counter-ballance to one, two, three, four, &c. Pounds, either plac'd in the Scale (or hung upon an Hook) and the Points are mark'd wherein *I* weighs, as one, two, three or four, &c. Pounds. See the *Plate*, *Fig.* 8.

From this Construction of the *Steel-Yard*, the Manner of using it is apparent, but the Instrument being very liable to Deceit, ought not to be countenanc'd in Commerce. See *Balance*.

Spring STEEL-YARD, a Kind of portable Balance, serving to weigh any Matter from about one to forty Pounds.

It is compos'd of a Brass Tube, into which goes a Rod, and about that is wound a Spring of tempered Steel, in a spiral Form. On this Rod are the Divisions of Pounds and Parts of a Pound, which are successively made by hanging on to a Hook, fastened to the other End, 1, 2, 3, 4, &c. Pounds.

Now the Spring being fastened by a Screw to the Bottom of the Rod, the greater Weight is hung on the Hook, the more will the Spring be contracted, and consequently a greater Part of the Rod will come out of the Tube; the Proportions of which greater Weights, are indicated by the Figures appearing against the Extremity of the Tube.

STEENING *of Wells*. See *Bricks*.

STEEPLE, is an Appendage erected on the Western End of a Church, to hold the Bells.

Steeples are named from their Form, either *Spires* or *Towers*.

Steeples are such as ascend continually, diminishing either conically or pyramidally.

The latter are mere Parallelopipeds, and are cover'd at Top, Plat-Form like.

In each Kind there is usually a Sort of Windows or Apertures, to let out Sounds, and so contriv'd at the same time as to drive it down.

Masius in his Treatise of Bells, treats likewise of Steeples.

The most remarkable Steeple in the World, is that at *Pisa*, which leans all on one Side, and appears every Moment ready to fall; yet without any Danger.

He observes that this odd Dispo-

Diſpoſition is not owing to the Shock of an Earthquake, as is generally imagin'd; but was ſo contriv'd at firſt by the Architect; as is evident from the Ceilings, Windows, Doors, &c. which are all in the Level.

STEPS, the ſame as *Stairs*.

STEREOMETRY, is that Part of *Geometry*, which teaches how to meaſure ſolid Bodies, *i. e.* to find the Solidity or ſolid Content of Bodies; as Cylinders, Cubes, &c.

STEREOTOMY is the Art or Science of cutting Solids, or making Sections thereof; as in Profiles of Architecture, in Walls and other Solids to be cut.

STILES [in *Joinery*, &c.] are the upright Pieces, which go from the Bottom to the Top in any Wainſcot.

STILLATORY, the Room in which a Still or Alembick is ſet up for Diſtillation.

STILOBATUM, the Body of the Pedeſtal of any Column.

STOCK-BRICKS. See *Bricks*.

STONE, is a hard, ſolid mineral Body, neither fuſible nor malleable, form'd in Succeſſion of Time in the Body of the Earth.

Of the Origin and Formation of Stones.

Mr. *Tournefort*, after a curious Survey of the famous Labyrinth of *Crete*, obſerves that ſeveral People had engraven their Names in the living Rock, wherewith its Walls were form'd; and what was very extraordinary, the Letters whereof they conſiſted, inſtead of being hollow, as they muſt have been at firſt (being all cut with the Points of Knives) were prominent, and ſtood out from the Surface of the Rock, like ſo many Baſſo Relievo's.

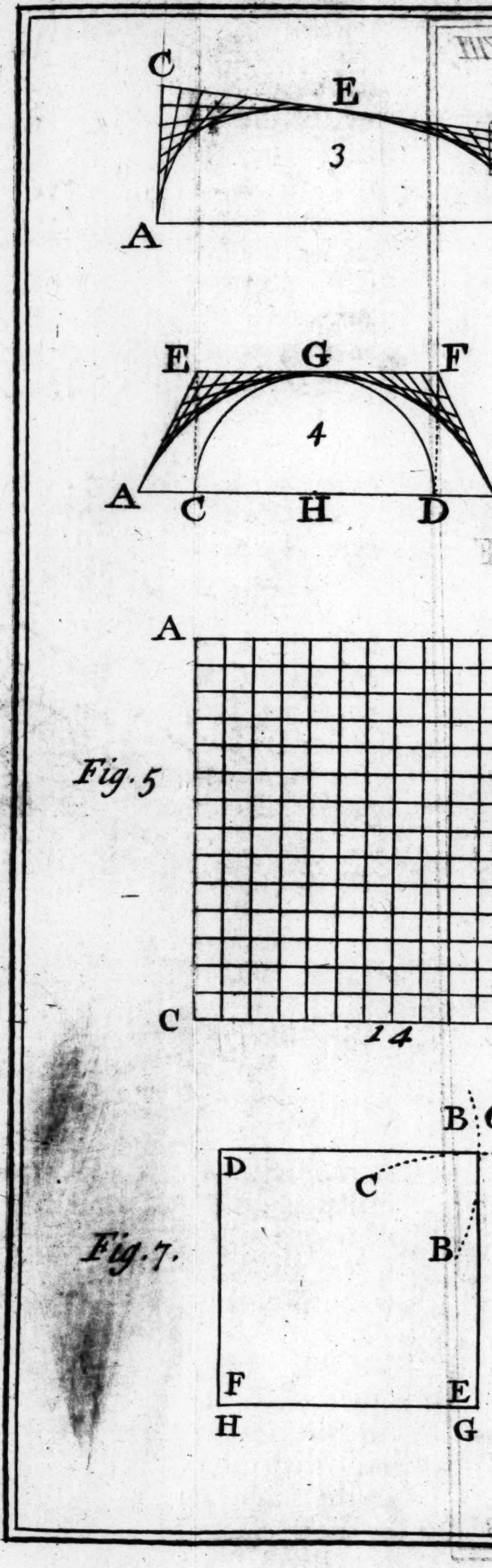
This Phænomenon is no other Way to be accounted for, then by ſuppoſing the Cavities of the Letters to have been fill'd up inſenſibly with a Matter iſſuing out of the Surface of the Rock; and which even iſſued with greater Abundance than was neceſſary for filling the Cavity.

The Wound of the Knife is heal'd up after the ſame Manner as the Fracture of a broken Bone is conſolidated by a Callus, form'd of the extravaſated nutritious Juice, which riſes above the Surface of the Bone; and this Reſemblance is the more proper, the Matter of the Letters being found whitiſh, when the Rock it ſelf was greyiſh,

Something very like this is found in the Barks of Trees, in which Letters have been cut with a Knife.

Mr. *Tournefort* ſupports his Opinion by ſimilar Callus, apparently form'd in ſeveral other Stones, which re-unite them after they have been broken by Accident.

From theſe Obſervations it follows, that there are Stones which grow in the Quarries, and conſequently that they are fed, and that the ſame Juice that nouriſhes them, ſerves to re-unite their Parts, when broken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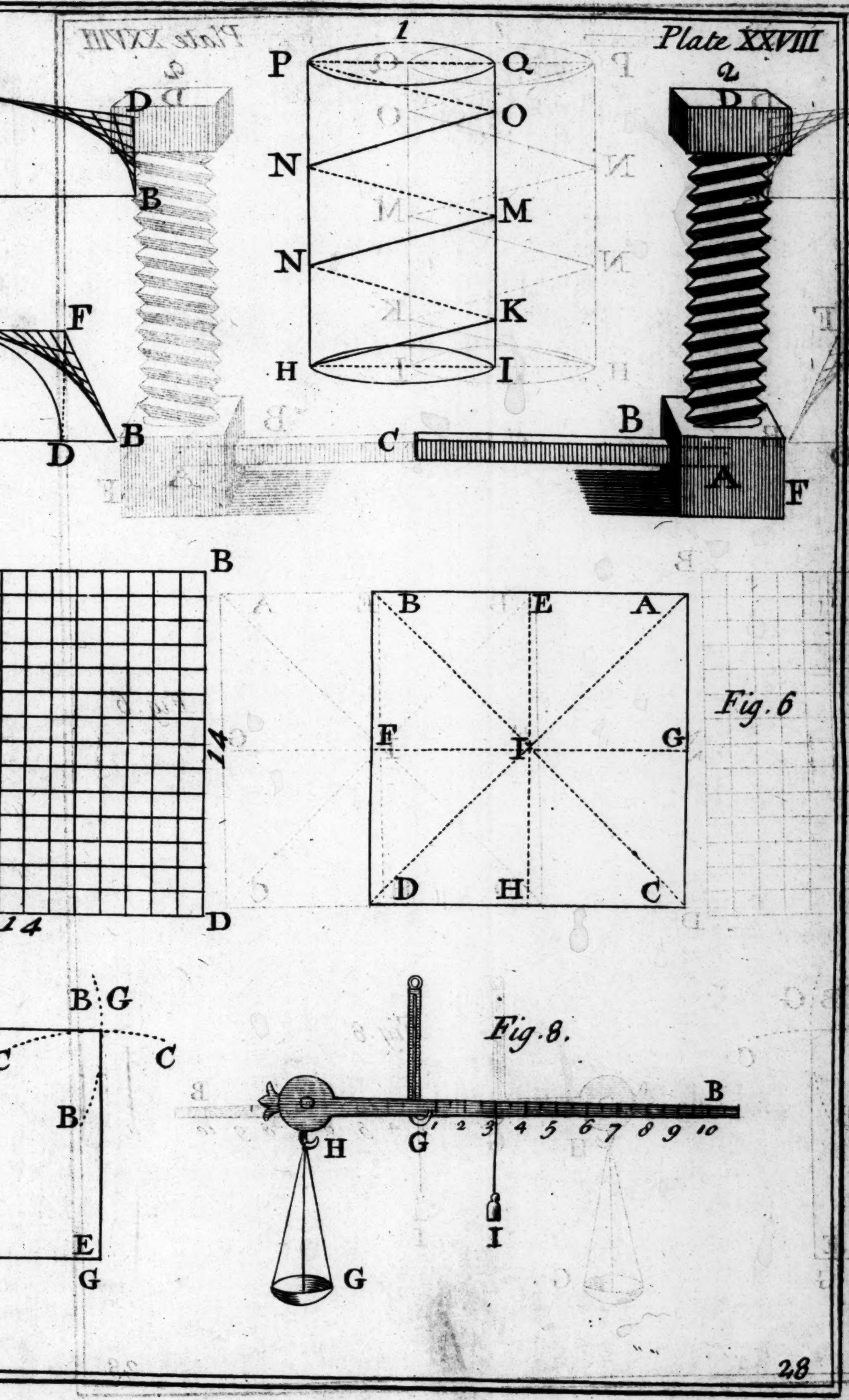
Plate XXVIII
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Fig. 6
B G
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Fig. 8.
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1 2 3 4 5 6 7 8 9 10
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G
28

oken, just as in the Bones of nimals, and Branches of Trees hen kept up by Bandages ; in fine, that they do vegete :

If so, there is no Room to ubt, but that they are organiz'd, or that they draw their tritious Juice from the Earth.

This Juice must be first filrated and prepar'd in their urface ; which may here be ccounted as a kind of Bark ; nd hence it must be convey'd o all the other Parts.

It is highly probable that he Juice which fill'd the Cavities of the Letters, was brought thither from the Bottom of the Roots of the Rock ; nor is there any more Difficulty in conceiving this, then in comprehending how the Sap should pass from the Roots of our largest Oaks to the very Extremity of the highest Branches.

It must indeed be own'd, that the Heart of these Trees is extremely hard ; and yet those of *Brasile*, &c. call'd Iron Wood, Ebony, *&c.* are much harder.

Coral is as hard in the Sea as out of it ; and Sea-Mushrooms, which all Persons allow to grow, are real Stones, and so, like the common Stones, are us'd in *America* in making Lime of.

It was never doubted but that Shells grew by Means of a nutritious Juice ; and yet this Juice is convey'd along the narrow Canals of these very hard Bodies, as well as those of Plants, which are not near so hard.

So that it must be allow'd that some Stones do vegetate and grow like Plants. Neither is this all ; but there is great Probability that they are generated in the same Manner ; at least, there is Abundance of Stones, the Generation of which is inconceivable, except they be suppos'd to come from a kind of Seed, in which the organical Parts of the Stones are wrapt in, as little as those of the largest Plants are in their Grains.

The Stones call'd *Cornu Ammonis*, *Lapis Judaicus*, *Astroites* ; those of *Bologne* and *Florence*, the several Kinds of *Pyrites*, and a great Number of others, suppose their several Seeds ; as Mushrooms, Truffles, and Mosses of various Kinds, whose Seeds were never yet discovered.

How should the *Cornu Ammonis*, which is constantly in the Figure of a Volute, be form'd without a Seed, containing that same Structure in little ? where are the Moulds in which they were form'd ? and who moulded them so artfully ? so far is it from being so, that these Stones are found in the Earth, like common Flints, nor have any Thing like Mould been ever discovered.

Mr. *Tournefort* examin'd the several Kinds of Stones abovemention'd, and finds them under the same Necessity of Seed. Again as to the immense Quantity of Flints, wherewith the *Crau of Arles* is covered, is a strong Argument in Behalf of this Theory.

The

The Country there for 20 Miles round, is full of round Flints; which are still found in equal Abundance, to what Depth soever you dig.

M. *Tournefort* observes, that among the Seeds of Stones, there are some which don't only grow soft by the Juices of the Earth; but also become liquid.

These then, if they penetrate the Pores of certain Bodies, grow hard, petrify and assume the Figure or Impression of the Body; thus those that are call'd *Pectinetes*, *Conchytes*, *Ostracites*, *&c.* are real Stones, the Liquid Seeds of which have insinuated into the Cavities of the Shells, call'd *Pecten*, *Concha*, *&c.*

On the Contrary, if these liquid Seeds fall on *Flints*, on Shells, Sand, *&c.* they inclose those several Bodies, and fixing between them, form a kind of Cement, which yet grows like other Stones.

It is highly probable, that such Rocks as are only an Assemblage of masticated Flints, have been form'd by a Number of those liquid Seeds; in like Manner as the Quarries full of Shells, unless the Rocks have invested these Bodies in their Growth.

He likewise adds, that there are Seeds of real Stones, inclos'd in the Spawn of certain Shell-Fish; as well as that hard solid Matter, destin'd to the forming of their Shells.

There is a particular kind of Shell-Fish, call'd *Pholas*, which is never found any where but in the Cavity of Flints which are always found exactly fitted to receive them.

Now it is highly improbable that the Fish should come and dig such a Niche to spawn in; it is much more likely that the Stones they are found inclos'd in, were at first soft, and that the Matter they are form'd of was originally found in the Spawn, in like Manner as the Matter which form'd the Egg-Shell, is really found in the Seed thereof.

From the Whole he concludes, that the Seed of Stones, and even of Metals, is a kind of Dust which probably falls from them, while they are alive, *i. e.* while they continue to vegetate, as above.

This Dust may be compar'd to the Seeds of several Plants, as those of *Ferns*, *Capillaries*, *Mosses*, *Truffles*, and the like, which no Microscope ever yet discovered, altho' their Existence is not at all doubted.

Probably Flints and Pebbles are among Stones, what Truffles are among Plants. *Pliny* assures us, that *Theophrastus*, *&c.* believ'd that Stones produc'd Stones; so that this Opinion does not seem improbable.

M. *Geoffry* accounts for the Origin and Formation of Stones, after another Manner.

He lays it down as a Principle, that all Stones without Exception, have been fluid or at least a soft Paste now dry'd and harden'd; witness the Stones, wherein foreign Bodies are found; also figured Stones, *&c.*

As to the Kinds of Stones, They are various, as *Marble*, *Fire-Stone*, *Purbeck-Stone*, *Rag-Stone*, *Alabaster*, *Free-Stone*, and *Common-Stone*. All which have been already treated on in their proper Places, Alphabetically.

As for *Free-Stone*, there is a Sort of Stone commonly dug in the Peninsula of *Portland*, in *Dorsetshire*, and commonly known by the Name of *Free-Stone*, which is much us'd in Building, it being much softer and whiter than Purbeck-Stone, and is usually rais'd out of the Quarries in bigger Blocks than Purbeck-Stone.

Some Authors call this *Portland-Stone*, *Free-Stone*, though there is a Sort of Stone found in *Oxfordshire*, which is call'd *Free-Stone*, and *Rigate*-Stone or *Fire*-Stone, is by some Authors call'd *Free-Stone*.

Common-Stone needs no Description, it being that which is commonly us'd and found almost every where; and of which I shall principally treat here.

Of the Nature of Stones.

The Honourable Mr. *Boyle*, tells us he could easily shew, that Ways (hitherto unus'd) might be found out (as he has partly try'd) to examine the Nature and Goodness of *Marble*, *Alabaster*, and other Stones.

That a competent Knowledge of the Sap that is to be found in Stones, employ'd in Building, is of so great Importance, that experienc'd Artificers have own'd, that the same Sort of Stone, taken out of the same Quarry, if dug at one Season, will moulder away in a very few Winters, whereas being dug at another Season, it will brave the Weather for very many Years, not to say Ages; and again, as there is some Sort of Stone that will decay in a few Years, so on the contrary there are others which will not attain to their full hardness in 30 or 40 Years, or a much longer time.

A certain Author says, that there are in some Places, Quarries of solid and useful Stone, which is employ'd about some stately Buildings, which is of such a Nature, that tho' being dug at a certain Season of the Year, it proves good and durable, yet being employ'd at a wrong time, it makes but ruinous Buildings, as has been found by sad Experience.

As to the Method of drawing Stones, *i. e.* getting them out of the Quarry. See *Quarry*.

A Load of Stone how much.] 25 Foot of Stone are reckon'd to the Load Superficial Measure, not 25 solid Feet; but measured upon the *Face* of the Stone.

To understand this Matter the more clearly, it is to be observ'd, that every squared Stone has six Plains or Sides, *viz.* the upper and under Bed, the Face and the Back, and the two Heads or Ends.

Of these six Planes, those two opposite ones, that are the cleaving Way of the Stone (and which in the Quarry lay paral-

parallel to the Horizon) are call'd the *Beds*; and of the best of the four Planes that are perpendicular to these (and consequently are the breaking Way of the Stone) they make the Face and the Plane opposite to the Face (which commonly goes rough, as it comes from the Quarry) they call the *Back* of a Stone; and the other two perpendicularPlanes, are call'd the Heads or Ends.

The Quantity of a Chord of Stones.] In some Places of *Kent*, Stones are sold by the Chord, consisting of 27 solid Feet, *viz.* three Feet long, three broad, and three high.

How much Walling a Load of Stones will do.] A Load of Stones will wall but about 20 Feet of 18 Inch Wall, which is accounted a Medium between what some say, speaking of the two Extremes, 15 and 25.

Soft Stones, how they are wrought smooth.] Some Stones are too soft to bear a good Edge; so that when they are scapt and wrought smooth, their Edges crumble off, and therefore (in this Case) to make them smooth, they proceed thus: After they are scapted, they have an old Card (such as Wool is carded with) and with it they work out the Strokes of the Ax; then bring it to a better liking, by rubbing it with a Piece of the same Stone.

The Price for drawing and carrying Stones, is for the drawing, about 3 *s.* the Load; and carrying (if it be not above half a Mile) 2 *s.* Some say they have drawn them for 9 *d.* the Load, when they lay almost level with the Ground, and requir'd but little uncoping.

As to the Price of scapting Stones.] Some reckon 5 *s.* the 100 Foot, this they say, is Journey-man's Wages, out of which the Master has but a small Profit; 50 Foot is reckon'd a Days Work, tho' some will do 60 in a Day, superficial Measure; and they reckon only the Face of the Stone, tho' they scapt five Sides to each Stone, *viz.* a Face, two Beds and two Ends, so the *Back* goes rough as it comes out of the Quarry. But in *scapting* (if they can conveniently) they chuse that for the Face of the Stone which will be most for their Advantage.

Of the Measuring of Stone Work.] Masons in some Parts of *Sussex*, have a Custom to measure their Stone Work thus; they apply one End of a Line to the Top of the Copeing, and so carry it along the Slant of the Copeing, and press it under the Toothing (if there be any) and from thence they carry it to the Water or Ground Table (if there be any such in the Wall) where they press it in likewise, and then they carry it over the Table to the Bottom of the Foundation; and this Dimension thus taken, they account for the Height, which multiply'd into the Length, gives the Content.

STORIES. Says M. *Le Clerc* in a publick Place intended for the Magnificence, as well as Convenience of a City, the Buildings

uildings cannot be too ſtately: ow as nothing carries more ate with it, than one grand rder, this is what muſt be ought on in the firſt Place: owever as Conveniency on is Occaſion is to be inſepara- e from Magnificence, I think o Stories may be allow'd in e Height of this one Order; d if the whole be rais'd on *Ruſtic* Order, 'twill be a great ddition to the Beauty of the rdonnance.

Over this grand Order, one ay raiſe a Balluſtrade, to ake it terminate more agree- bly, and to conceal in ſome eaſure the Roof, which is ever found any great Orna- ent to a beautiful Building.

Inſtead of Pilaſters one might ace an Ornament of inſulate olumns with a Corridore or allery behind; which would ſtill infinitely better.

STOVE, a hot Houſe or oom.

Palladio obſerves that the ncients us'd to warm their ooms by certain ſecret Pipes, hich came thro' the Walls, nveying Heat to ſeveral Parts the Houſe, from one com- on Furnace. Whether this re a common Cuſtom, ſays *Henry Wootton*, or a Curio- , we cannot determine; but was certainly both for Profit d Uſe, far beyond the *Ger- n* Uſe.

STOVE, a Kitchen Term, ing a Sort of Furnace, where y dreſs Pottages, and where y prepare Ragoes. It is de of Brick-Work, furniſh'd h Chaffing - Diſhes above, and an Aſh-Pan underneath.

STOVES in Gardens, are Contrivances for preſerving ſuch tender Exotick Plants, which will not live in our Nor- thern Climates, without artifi- cial Warmth in Winter. Theſe are chiefly of two Sorts, call'd *Dry-Stoves* and *Bark-Stoves.*

A Dry Stove is ſo contriv'd, that the *Flues* through which the Smoke paſſes, are either carried under the Pavement of the Floor, or elſe are erec- ted in the back Part of the Houſe, over each other, like Steps.

This Stove may either be built with upright and ſloping Glaſſes at the Top, in the ſame Manner as in the Bark- Stove, or elſe the Front Glaſſes which ſhould run from the Floor to the Ceiling, may be laid ſloping to an Angle of 45 Degrees, the better to admit the Rays of the Sun in *Spring* and *Autumn.*

The latter Method has been chiefly followed by moſt Per- ſons who have built theſe Sorts of Stoves; but a very inge- nious Author ſays, that were he to have the Contrivance of a Stove of this Kind, he would have it built after the Model of the Bark-Stove, with up- right Glaſſes in the Front, and ſloping Glaſſes over them, be- cauſe this will more eaſily ad- mit the Sun, at all the different Seaſons; for in *Summer*, when the Sun is high, the Top Glaſ- ſes will admit the Rays to ſhine almoſt all over the Houſe; and in *Winter*, when the Sun is low, the Front Glaſ- ſes

ſes will admit its Rays; whereas when the Glaſſes are laid to any Declivity in one Direction, the Rays of the Sun will not fall directly thereon above a Fortnight in *Autumn*; and about the ſame time in the *Spring*, and during the other Parts of the Year, they will fall obliquely thereon; and in *Summer*, when the Sun is high, the Rays will not reach above five or ſix Feet from the Glaſſes.

And ſo the Plants plac'd towards the back Part of the Houſe, will not thrive in the Summer Seaſon for want of Air, whereas when they are ſloping Glaſſes at the Top, which run within four Feet of the Back of the Houſe, theſe by being drawn down in hot Weather, will let in perpendicular Air to all the Plants; and of what Service this is to all the Plants, few are ignorant who have made Obſervations on the Growth of Plants in a Stove. For when Plants are plac'd under Covert of a Ceiling, they always turn themſelves towards the Air and Light, and by that Means deviate from their erect Direction, and grow crooked; and if you turn them every Week, in Order to preſerve their erect Poſture, they will nevertheleſs grow weak, and look pale and ſickly.

As to the further Contrivance of this Sort of *Dry Stove*, the Temper of the Place ought to be conſidered, whether the Situation be dry or wet; if it be dry, then the Floor need not be rais'd above two Feet abo the level of the Ground; b if it be wet, let it be rais three Feet, becauſe as t Flues are to be carried und the Floor, ſo when they a made under, or cloſe upon t Surface of the Ground, th will raiſe a Damp; neither w they draw ſo well, as wh they are more elevated.

The Furnace of this Sto may be plac'd either at t back Part of the Houſe, or one End, according as the Co venicy of the Building do permit.

This alſo muſt be made a cording to the Fuel intend to be burnt, which if for Co or Wood, may be made accor ing to the common Meth for Coppers, but only mu larger, becauſe as the Fire is be continued in the Nig chiefly, ſo if there is not Ro to contain a ſufficient Quant of Fuel, it will require t Trouble of attending the Fi in the Night, which, if ne lected, would be of dang rous Conſequence to the Plan

But if the Fuel intended be burnt, be Turf; then t Contrivance of the Furna may be the ſame as for t *Bark Stove*.

The Flues of this Sto ſhould be turn'd in Angl after the following Mann ΛΛΛΛΛΛΛ, which will ca them to draw better than they were ſtrait, and by bei diſpos'd in this Method, t will reach from the Back to t Front of the Houſe.

They ſhould not be leſs

Dep

epth than 18 Inches, and very ar the same in Width, which ll prevent them from being n choak'd up with Soot.

The Spaces between the ues should be fill'd up with her dry Brick, Rubbish, me or Sand, from which but le Moisture can arise; and Flues should be closely stered with Loam both with- and without, and the upper rt of them covered with a rse Cloth under the Floor, hinder the Smoke from get- g into the House.

When the Flue is carried m the Furnace to the End the House, it may be re- n'd in the Back, above the or, in a strait Line, which y be contriv'd to appear like ep or two; by which Means Smoke will be continued e House, until all its Heat ent: which will warm the of the House the better.

he Chimneys thro' which Smoke is to pass, may be er at both Ends, or in the dle, carried up in the Thick- of the Brickwork of the ls, so as not to appear in t.

he Flues should be first 'd either with Iron Plates oad Tiles, and then a Bed and over them, about two es thick, upon which the Tiles should be laid, to spond with the Rest of Floor.

his Thickness of Cover be full enough to hinder oo sudden Rise of the from the Flues.

t if the Furnace is plac'd under the Floor, the Thickness of Sand between the Iron Plate which covers it and the Floor, ought not to be less than four Inches; wherefore the Bottom of the Furnace ought to be sunk lower; and if the Flues are laid a little rising from the Fire-Place to the End of the House, it will be a Means to make them draw the better; but this Rise must be allow'd in placing them lower under the Floor, next the Fire, because if the Floor be not laid perfectly level, it would appear unsightly.

Bark Stoves are such as have a large Pit, pretty near the Length of the House, three Feet in Depth, and six or seven in Breadth, according as the House is in Breadth.

This Pit is to be fill'd with fresh *Tanner's Bark*, to make a hot Bed, and in this Bed, the Pots of the most tender Exotic Trees and herbacious Plants are to be plung'd.

The Dimension of this Stove should be in Proportion to the Number of Plants that are to be plac'd in it; but as to the Length it should not exceed 40 Feet, except it have two Fire Places, in which Case it would be proper to make a Partition of Glass in the middle, and also two Tan-Pits, that there may be two different Heats for Plants of different Climates, which would be of great Advantage to the Plants, because they may have the Air in each Division shifted, by sliding the Glasses of the Partitions, or by opening the Glass

Door, which ſhould be made between every Diviſion, altho' there ſhould be three or more Diviſions in the Range, and this Door would alſo be an eaſy Paſſage from one Diviſion to another.

This *Stove* ought to be rais'd above the Level of the Ground proportionally to the Drieneſs of the Place, and the whole ſhould be built on the Top of the Ground, if the Situation be moiſt; ſo that the Brick-work in Front, muſt be rais'd three Feet above the Surface, which is the full Depth of the Bark-Bed; by which Means none of the Bark will be in Danger of lying in the Water.

But on the other Hand, if the Soil be dry, the Brick-work in Front, need not be more than one Foot above Ground, and the Pit may be ſunk two Feet below the Surface.

Upon the Top of this Brick-work, in Front, muſt be laid the Plate of Timber, into which the wooden Work of the Frame is to be faſtened, and the upright Timbers in Front, ſhould be plac'd four Feet aſunder, or ſomewhat more, which is the Proportion of the Glaſs Doors or Saſhes.

Theſe ought to be about ſix Feet and a half, or ſeven Feet in Length, and plac'd upright; but from the Top of theſe ſhould be ſloping Glaſſes, which ſhould reach within three Feet of the Back of the Stove, where there is to be a ſtrong Crown-Piece of Timber plac'd, in which is to be a Groove

made for the Glaſſes to ſli in.

The Wall in the Back the Stove, ſhould be a Br and half thick, and carried about nine Feet above the S face of the Bark-Bed: from the Top of this W there ſhould be a ſloping R to the Crown Piece in wh the Glaſſes ſlide.

This Crown Piece ſhould in Height about 16 Feet fr the Surface of the Bark- or Floor, which will giv Declivity to the ſloping G ſes, ſufficient to carry off Wet, and be high enough contain many tall Plants. back Roof of this, may be ther covered with Lead, ſl or tiled.

In the Front of the H there ought to be a Walk a a Foot and half or better for the Conveniency of walk and next to this ſhould Bark-Bed be plac'd, w ſhould be proportionabl Width to the Breadth of Houſe: as if the Houſe b Feet wide, the Pit may Feet wide; behind which t ſhould be a Walk of a and half, for a Paſſage for tering the Plants in the and then there will be a 22 Inches vacant next the Wall, for erecting the F which muſt all be rais'd a the Top of the Bark- theſe Flues ought to be 1 ches broad in the Clear, they may not be too ſoon ſt with the Soot; and the Flue into which the Sm firſt enters from the

ſh

ould be two Feet deep in the ear, and this may be covered her with cast Iron Plates or oad Tiles; over this the se- d Flue must be returned ck again, which may be a ot and an half deep, and co- ed on the Top, as before, l so in like Manner, the es may be return'd over h other three or four times, t the Heat may be spent fore the Smoke passes off.

The Thickness of the Wall the Front of these Flues, d not be more than four hes; but must be well joint- with Mortar, and plastered hinside to hinder the Smoke n getting into the House; l the Outside should be fac'd h Mortar, and cover'd with coarse Cloth, to keep the rtar from cracking; as is ctis'd in setting up Coppers. f this be perform'd care- y, there will be no Danger the Smoke getting into the use, which cannot be too efully avoided; for nothing ore offensive to Plants than oke, which will cause them rop their Leaves, and if it inue long in the House, destroy them utterly.

he Fire Place may be e either in the middle, or ne End, according as Con- iency will permit, but rever it is plac'd, it should a Shed over it, and not xpos'd to the open Air; if the Wind has full In- to it, it will be impossible ake the Fire burn equally, it will also be troublesome tend the Fire in wet Wea- ther, where it is expos'd to Rain.

The Contrivance of the Fur- nace, ought to be according to the Fuel intended to be burned in it; but Turf being the best Fireing for Stoves, where it can be had, because it burns more moderately than any other Sort of Fuel, and so requires lesser Attendance, so I shall describe a proper Sort of Fur- nace for that Purpose.

The whole of this Furnace ought to be erected within the House, which will be a great Addition to the Heat, and the Front Wall on the out- side of the Fire Place, next the Shed, ought to be two Bricks thick, the better to pre- vent the Heat from coming out that Way.

The Door of the Furnace at which the Fuel is put in, must be as small as conveniently may be, to admit of Fuel; and this Door should be plac'd near the upper Part of the Furnace, and made to shut as close us possible, so that but little of the Heat may pass off through it.

This Furnace should be in Depth about 20 Inches, and as much square in the Bottom; but may be slop'd off on every Side, so as to be two Feet square at the Top; and under this Furnace, should be a Place for the Ashes to fall into, in Depth about a Foot, and of the Width of the Bottom of the Furnace.

This should have an Iron Door, to shut as close as possi- ble; but just over the Ash-

Hole, above the Bars which ſupport the Fuel, ſhould be a ſquare Hole about four Inches wide, to let in Air to make the Fire burn; this muſt alſo have an Iron Frame and Door, to ſhut cloſe, when the Fire is perfectly lighted, which will make the Fuel laſt the longer, and the Heat will be the more moderate.

The Top of this Furnace ought to be nearly equal to the Top of the Bark-Bed, that the loweſt Flue may be above the Fire, ſo that there may be a greater Draught from the Smoke, and the Furnace muſt be covered with a large Iron Plate, cloſely cemented to the Brick work, to prevent the Smoke from getting out.

Alſo great Care is to be taken, wherever the Fire is plac'd, that it be not too near the Bark-Bed; for the Heat of the Fire will, by its long Continuance, dry the Bark, ſo that it will loſe its Vertue, and be in Danger of taking Fire; to prevent which, it will be the beſt Way to continue a Hollow between the Brick-work of the Fire and that of the Pit, about the Width of a Foot and a half, which will effectually prevent any Damage that might otherwiſe happen from the Heat of the Fire.

And no Wood-work muſt be plac'd any where near the Flues or the Fire Place, becauſe the continual Heat of the Stove may in Time dry it ſo much as to cauſe it to take Fire, which cannot be too carefully guarded againſt.

The Entrance into this St[ove] ſhould be either from a Gr[een] Houſe, the Dry Stove, or [...] through the Shed, where [...] Fire is made, becauſe in c[old] Weather, the Front Gla[sses] muſt not be opened.

The Inſide of the Ho[use] muſt be clean white-waſh[ed] becauſe the whiter the b[ack] Part of the Houſe is, the b[et]ter it will reflect the Li[ght] which is of great Conſeque[nce] to Plants, eſpecially in *Win[ter]* when you are oblig'd to k[eep] the Stove clean ſhut up.

Over the Top-ſliding G[las]ſes, there ſhould either [...] wooden Shutters or Tarpaw[lings] to roll down over them in [...] Weather, to prevent the [...] from getting through the G[las]ſes, and alſo to ſecure th[em] from being broke by Storm[s of] Hail; and theſe Outer-Co[ver]ings will be ſerviceable [to] keep out the Froſt.

STRAIT [with *Brick[lay]ers*] a Term us'd for half [...] more or leſs than half o[f a] Tile.

Theſe are ordinarily us'd [at] the Gable Ends, where t[hey] are laid at every other Cou[rse] to cauſe the Tiles to *br[eak] Joint* (as they phraſe it) [...] is that the Joints of one Cou[rse] may not anſwer exactly to [the] Joints of the next Courſe [ei]ther above or below it.

STRAIGHT ARCH. [See] *Arch*.

STRETCHERS. See *A[...]*

STRUCTURE. See *Bu[ild]ing*.

STRIÆ [in the ancient [Ar]chitecture] are the Liſts, [...]

or Rays, which separate Striges or Flutings of Co-lumns.

STRIGES [in the ancient Architecture] are what in the Modern we call *Flutings*.

They are thus call'd, as suppos'd to have been originally intended to imitate the Folds or Plaits of Women's Robes; which are by the *Latins* call'd *Striges*.

STUC [in *Masonry*] is a Composition of Lime and Dust of white Marble. pounded together and sifted; of which Figures and other Ornaments of Sculpture are made.

STUFF [with *Joiners*, &c.] the Wood they work on.

STYLOBATÆ, the same as *Pedestals*.

SUB-CONTRARY *Position* [in *Geometry*] is when two similar Triangles are so plac'd as to have one common Angle at their Vertex, and yet their Bases not parallel.

SUBDUCTION [in *Arithmetick*] the same as *Subtraction*.

SUBDUPLE *Ratio*, is when one Number or Quantity is contain'd in another twice, thus 3 is said to be a Subduple of 6, as 6 is Duple of 3.

SUBSTRUCTION [in *Building*] See *Foundation*.

SUBTENSE [in *Geometry*] a Right Line opposite to an Angle, and presum'd to be drawn between the two Extremities of the Arch, which measures that Angle.

SUMMER [in *Architecture*] a large Stone, the first that is laid over Columns and Pilasters in beginning, to make a cross Vault; or it is the Stone which being laid over a Piedroit or Column, is hollowed, to receive the first Haunce of a Plat-Band.

SUMMER [in *Carpentry*] is a large Piece of Timber, which being supported on two stout Peers or Posts, serves as a Lintel to a Door, Window, &c.

There are also *Summers* in various Engines, &c. serving to sustain the Weight.

SUMMER-HOUSE, a little Edifice erected at the Corner of a Garden, and contriv'd so as to let in Air on all Sides; or to exclude it, as you find it refreshing or inconvenient, by having Windows or Doors plac'd accordingly.

SUMMER-TREE, a Beam full of Mortoises, for the Ends of Joists to lie in. See *Bress Summers* and *Girders*.

SUMMET } the Vertex or
SUMMIT } Point of any Body, as of a Triangle, a Pyramid, a Pediment, &c.

SUPERCILIUM [in the ancient *Architecture*] the uppermost Member of the Cornice, call'd by the Moderns *Corona*, *Crown* or *Larmier*.

It is also us'd for a square Member under the upper *Tore* of some Pedestals. Some Authors confound it with the *Tore* it self.

SUPERFICIES [in *Geometry*] i. e. Surface, a Magnitude consider'd as having two Dimensions; or extended in Length and Breadth; but without Thickness or Depth.

In Bodies the *Superficies* is

all that preſents it ſelf to the Eye.

A Superficies is chiefly conſidered as the external Part of a Solid, when we ſpeak of a Surface ſimply, and without any Regard to Body, we uſually call it Figure.

A Rectilinear SUPERFICIES, is that comprehended between Right Lines.

A Curvilinear SUPERFICIES, is that comprehended between Curve Lines.

A Plane SUPERFICIES is that which has no Inequality, but lies even between its boundary Lines.

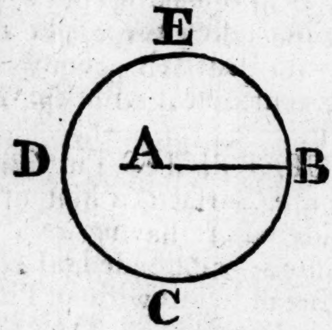
A Concave SUPERFICIES is the internal Part of an orbicular Body.

A Convex SUPERFICIES is the exterior Part of a ſpherical Body.

The Meaſure or Quantity of a Superficies or Surface, is call'd the *Area* of it.

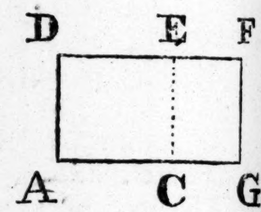
The finding the Meaſure or Area of a Superficies is call'd the Quadrature of it.

SUPERFICIES is that which hath only Longitude and Latitude, that is Length and Breadth without Depth or Thickneſs.



As Right Lines are generated by the Motion of P[oints,] ſo are Superficies by the [Mo]tion of Right Lines.

For *Firſt*, If the Right [Line] A B be fix'd at A, as [a] Centre, and the Point B m[ov'd] to C, thence to D, and [from] thence to E, and laſtly t[o B,] it will by its Revolution [de]ſcribe a Superficies, whic[h is] call'd a Circle.



2. If the Right Line [ ] be mov'd along the Line [ ] until A C is equal to [ ] that is, in the Poſition C [ ] will by its Motion deſcri[be a] Geometrical Square, A D[ ] and if continued on to F G[ ] will generate the Parallelo[gram] A D F G.

SYMMETRY, The [ ]tion or Equality in the H[eight,] Length and Breadth of [the] Parts neceſſary to comp[ose a] beautiful Whole.

Vitruvius makes Sym[metry] to conſiſt in the Union [and] Conformity of Relation o[f the] Members of a Work to [the] whole, and of each of th[e ſe]parate Parts to the Beau[ty of] the intire Work; Regar[d be]ing had to ſome certain [Mea]ſure, ſo that the Body is f[ormed] with Symmetry by the [rela]tion the Arm, Elbow, [ ] Fingers, &c. have to ea[ch o]ther, and to their Whole.

SYMMETRY [in [ ]

ture] is call'd *uniform Symmetry*, and is that where Ordonnance reigns in the same manner throughout the whole Contour.

Respective SYMMETRY is that wherein the opposite Sides are equal to each other.

T

TABERN, a Cellar.

TABLE [in *Architecture*] is a smooth simple Member or Ornament of various Forms; but most usually in that of a long Square.

A Projecting Table, is that which stands out from the Naked of the Wall, Pedestal, or other Matter it adorns.

Raked Table, is that which is hollow'd in the Die of a Pedestal, or elsewhere, as is usually encompass'd with a Moulding.

Razed Table is an Imbossment in a Frontispiece for the putting an Inscription or other Ornament in Sculpture. This is what M. *Perrault* understands by *Abacus* in *Vitruvius*.

Crown'd Table, that which is cover'd with a Cornice, and in which a Basso Relievo is cut, or a Piece of black Marble incrustated for an Inscription.

Rusticated Table, that which is pick'd, and whose Surface seems rough, as in Grotto's, &c.

TABLE [in *Perspective*] is a Plain Surface suppos'd to be transparent, and perpendicular to the Horizon.

It is always imagin'd to be plac'd at a certain Distance between the Eye and the Objects, for the Objects to be represented thereon, by Means of the visual Rays passing from every Point thereof, thro' the Table to the Eye, whence it is call'd a Perspective Plane.

TABLE *of Glass*, See *Case of Glass*.

TABLES or PANNELS. The Tables in the Die of the Pedestal, ought to be equal to the Width of the Column; that is two Modules: now the Width of the Die being two Modules, says M. *Le Clerc*, 24 Minutes, there remains 12 Minutes for the Width of the List that goes round it; tho' towards the Bottom it must be somewhat wider, and may be pretty well fix'd at 15 Minutes.

When these Tables are of Marble, he chuses rather to have them fix'd even with the Die. However, if they are to be sunk lower, the Inequality ought not ordinarily to exceed a Minute and a half; in which Case they should have a Baguette, or a little Talon or Cavetto for a Border.

In these Tables are sometimes added *Basso Relievo's* which may be of Marble, of Brass, or even of Brass gilt: but special Care must be taken that the Relievo never project beyond the Naked of the Die.

The Sculptor therefore, in this Case, must take a sufficient Depth for the Ground of this Work, and the Work it self must be rais'd as little as possible.

Some Architects bound these

Tables with a little Border, projecting beyond the Naked of the Die; but M. *Le Clerc* is of Opinion, that they ought not to be imitated herein, such a projecting Moulding or Frame agreeing very ill with the Astragal above it, and which it self projects nearly as much, as the Baguette that terminates the Bottom of the Corniche.

To which it may be added, that so many little Mouldings being found, almost at an equal Distance from one another, have an ill Effect; for it must be remembred, that the beautiful Distribution of Mouldings, consists in observing a Diversity in their Bignesses, Figures and Distances.

TACKS. See *Nails*.

TAILLOIR [in *Architecture*] a Term us'd by some Writers, in Imitation of the *French*, for *Abacus*.

TALON [in *Architecture*] a Kind of Astragal or Moulding, consisting of a square Fillet, crowning a Cymatium, frequently found to terminate Ornaments of Joiners Work, as those of Doors, &c.

TALON. M. *Le Clerc* says, that when a little *Talon* or *Gula* serves as a *Cymaise*, particularly when it terminates an Impost, or when it terminates the Cornice of the Pedestals, He gives it a Fillet something stronger than what he uses to do, when it is found inclos'd between other Mouldings.

He makes the Fillet of the first the stronger, because being more expos'd, it is more liable to be broken; besides, that these last Mouldings ways appear more delicate really they are, by Reaso the Air, which seems to something off from their Bu

The Height of this Fi is half that of the Talon, that of the Second, only a th

TALUS } [in *Architect*
TALUT } the sensible clination or Slope of a W as of the Outside of a W when its Thickness is dimini by Degrees, as it rises in Hei to make it the firmer.

TAMBOUR [in *Archi ture*] is a Term apply'd to *Corinthian* and *Composite* C tals; as bearing some Res blance to a Drum, which *Tam bour* signifies in *French*.

Some call it Vase, and ot the Campana or Bell.

TAMBOUR is also us' signify a little Box of Tim Work, cover'd with a Ceil on the Inside the Porch of tain Churches; both to pre the View of Persons passing and to keep off the Wind the Means of folding Doors

TAMBOUR is also us'd a round Stone, or Cours Stones, several of which f for a Section of the Shaft Column.

TANGENT [in *Geome* is a Right Line, which tou a Circle which meets it in a Manner, as that tho' it infinitely produc'd, it w never cut the same; tha never come within the Circ ference of it: thus the A D, is a Tangent to the cle in D. See *Plate*, *Fig.*

'Tis demonstrated in th

gure, that if the Tangent A D, and a Secant A B, be both drawn from the same Point A, the Square of the Tangent will be equal to the Rectangle, under the whole Secant A B, and that Portion thereof A C, will fall without the Circle.

2. That if two Tangents, A D, A E, be drawn to the same Circle, from the same Point A, they will be equal to each other.

TANGENT [in *Trigonometry*] a Tangent of an Arch is a Right-Line, rais'd perpenlarly on the Extreme of the Diameter, and continued to a Point, where it is cut by a *Secant*; that is, by a Line drawn from the Centre, through the Extremity of the Arch whereof it is a *Tangent*.

Or thus, a *Tangent* of an Arch E A, is a Part of a Tangent of a Circle (that is, of a Right-Line which touches a Circle without cutting it) intercepted between two Right-Lines drawn from the Centre C through the Extremes of the Arch E and A. See *Plate*, *Fig.* 2.

TAPER / TAPERING [in *Joinery*, &c.] is understood of a Piece of Board, Timber, or the like, when it is broad beneath, and sharp towards the Top, or diminishing gradually from the biggest End.

TARRASS / TERRASS a Sort of Plaster, or strong Mortar, chiefly us'd in lineing Basons, Cisterns, Wells, and other Reservoirs of Water.

TARRASS / TERRAS [in *Architecture*] an open Walk or Gallery; also a flat Roof of an House.

TASSELS [in *Building*] are Pieces of Board that lie under the Mantle-Tree.

TEETH. See *Dentils*.

TEMPLE [in *Architecture*] The ancient Temples were distinguish'd in Respect to their Construction into various Kinds, as,

Temples *of Antæ*, or single *Antæ*; these, according to *Vitruvius*, were the most simple of all Temples; having only angular Pilasters, call'd *Antæ* or *Parastatæ*, at the Corners, and two *Tuscan* Columns on each Side the Doors.

Tetrastyle Temple or singly Tetrastyle; was a Temple which had four Columns in the Front, and as many behind; as that of *Fortuna Virilis* at *Rome*.

Prostyle Temple, is one which had Columns only in the Front or Fore-side, as that of *Ceres*, at *Eleusis* in *Greece*.

Amphi-Prostyle Temple, *i.e.* Double Prostyle, was one that had Columns both before and behind, and which was also call'd *Tetrastyle*.

Periptere Temple, one which had four Rows of insulated Columns around, and was also *Hexastyle*. *i. e.* had six Columns in Front; as the Temple of *Honour* at *Rome*.

Diptere Temple, is one which had eight Rows of Columns around, and was also *Octostyle*; or had eight Columns in Front, as that of *Diana* at *Ephesus*.

TENON, TENNON [in *Carpentry*, &c.] is the End of a Piece of Wood, diminish'd by one third of its Thickness, to be receiv'd into a Hole in another Piece, call'd a *Mortoise*, for the jointing or fastening the two together.

It is made in various Forms; square, dove-tail'd for double Mortoises, and the like.

TENIA. See *Tænia* and *List*.

TERM [in *Geometry*] sometimes signifies a Point, sometimes a Line, *&c.* a Line is the Term of a Superficies, and a Superficies of a Solid.

TERM, TERMINUS [in *Architecture*] is a Sort of Statue or Column, adorn'd at the Top with the Figure of the Head of a Man, a Woman, or Satyr, as the Capital, and the lower Part ending in a kind of Sheath or Scabbard.

These *Terms* are sometimes us'd as Consoles, and sustain Entablatures; and sometimes as Statues to adorn Gardens.

Some call these *Thermes*, and derive the Name from *Hermes*, a Name given by the *Greeks* to the God *Mercury*, whose Statue made after this Manner, was plac'd in several Cross-Ways in the City of *Athens*.

Others derive the Name from the *Roman* Deity *Terminus*, who was accounted by them the Protector of Land-Marks.

Whose Statue (made without Hands and Feet, that he might not change his Place) was usually planted at the Bounds of Land, to separate them.

Of these *Termin's* the Ancients made great Variety, *viz.* *Angelick*, *Rustic*, *Marine*, *Double*, *in Bust*, *&c.*

Milliary TERMS, among the ancient *Greeks*; were Heads of certain Divinities, plac'd on square Land-Marks of Stone, or on a Kind of Sheath, to mark the several Stadia, *&c.* in the Roads.

They were usually dedicated to *Mercury*, whom the *Greeks* believ'd to preside over Highways. Some of them were represented with four Heads; such as are still to be seen in *Rome*, at the End of the *Fabrician* Bridge, thence call'd *Ponte de quattre Capi*.

To give them a Figure proper to represent a delicate Column, their Arms are lop'd off, and their Body does not appear below the Girdle; these *Terms* are very proper in the Decorations of a Theatre, as also in Pieces of Architecture, *de Creillage* (as it is call'd by M. *Le Clerc*,) *i. e.* crail'd work Kind.

These *Terms* or *Termini* have this in common with the *Caryates* (or Cariatic Columns) that they should never be brought to match with the common Columns: this Adventage however they have in particular, that you may give them what Degree of Delicacy you please, by lengthening out their Sheath, and raising the Figures to any Height that you would have.

By

By this Means they may be made to suit gay, airy Arches, such as Cabinets, Salloons and Arbours, which are requir'd especially in crailed Work.

M. *Le Clerc* adds, that in his Opinion, it is not reasonable to reduce the Figures of Angels into *Termini*; tho' we see it has been formerly done in Places of Distinction.

TERRACE } a Bank of
TERRASS } Earth, rais'd in a Garden, Court, *&c.* above the Level of the Ground.

The *Terrace* is a Breast-Work, usually lin'd and breasted with a strong Wall; in Compliance with the natural Inequality of the Ground.

Sometimes it is made in *Talus*, or aslope, and cover'd with Turf.

Counter TERRACE, is a Terrace rais'd over another, for the joining of the Ground, or the raising a Parterre.

TERRACE [in *Building*] is us'd to signify the Roofs of Houses which are flat, and may be walk'd upon; as also Balconies, which project.

The *Terrace* is properly the Covering of a Building which is in Platform; as that of the *Perystile* of the *Louvre*; or that of the Observatory, pav'd with Flint and Mortar.

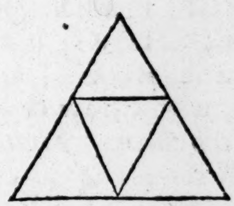
All the Buildings of the Eastern Nations are covered with Terrasses, to take the fresh Air on, and even to lie on.

TESSELATED *Pavement*, is a rich Pavement of Mosaic Work, made of curious small square Marbles, Bricks or Tiles, call'd *Tesselæ*, from the Form of Tiles.

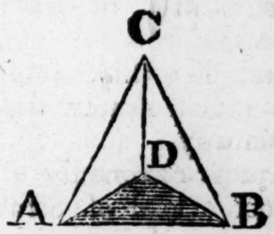
TETRACTYS [in the ancient *Geometry*] the *Pythagoric Tetractys* is a Point, a Line, a Surface and a Solid.

TETRADORON. See *Brick*.

TETRAEDRON } [in
TETRAHEDRON } *Geometry*] is one of the five Regular or Platonic Bodies or Solids; comprehended under four equilateral and equal Angles.



The *Tetraedron* may be conceiv'd as a triangular Pyramid of four equal Faces, as in the Figure.



'Tis demonstrated by Mathematicians, that the Square of the Side of a *Tetraedron* is to the Square of the Diameter of a Sphere, wherein it may be inscrib'd in a subsesquialteral Ratio: whence it follows, that the Side of a *Tetraedron* is to the Diameter of a Sphere it is inscrib'd in, as $\sqrt{2}$ to the $\sqrt{3}$, consequently they are incommensurable.

TETRAGON [in *Geometry*] is a Quadrangle, or a Figure

gure with four Angles: thus a *Square*, *Parallelogram*, *Rhombus*, and *Trapezium*, are tetragonal Figures.

TETRAGONISM, is us'd by ſome to ſignify the Quadrature of a Circle.

TETRASTYLE [in the ancient *Architecture*] was a Building, and particularly a Temple, having four Columns, both before and behind, *i. e.* in Front and Rear.

THACK TILES. See *Tiles.*

THATCHING, is the Covering the Roof of a Houſe or Barn, with Straw or Reeds.

1. *With Straw*] *Thatch* (ſays Mr. *Worlidge*,) is a common Covering in many Places, yet in ſome to be preferr'd before other ſome; and that the beſt that he has ſeen, is that which is call'd *Helin*, *i. e.* long and ſtiff Wheat Straw (with the Ears cut off) bound up in Bundles unbruis'd; which if well laid, lies thin, laſts long, and is much neater than the common way.

There is commonly allow'd two good Load of Straw for five Square of Thatching, or one Load to $2\frac{1}{2}$ Square.

Some are ſaid to have pretended that they could thatch a Roof, ſo that no Mouſe could get in; but I know no Inſtance of any ſuch Thing to have been done.

In ſome Parts of *Kent*, they don't uſe *Withs* to bind on their thatching Rods, but inſtead of that, uſe *Rope-Yarn*, (as they call it) which is a ſingle ſtranded Line, about the Size of a Penny Cord; pitched with Pitch, after the ſame Manner as ſome do their Well Ropes.

This coſts about 2 *d. per* Pound, a Pound of which will do a Square of Thatching. This, ſome ſay, is more durable than Withs; for that Withs when they are grown Sear, will fly and break, but this will not.

2. *Thatching with Reeds.*] This Kind of Thatching is ſaid to laſt 40, 50 or 60 Years.

Theſe Reeds in *Suſſex* and *Kent*, are ſold by the Thouſand, *viz.* a 1000 Handfuls, each Handful being 8, 9 or 10 Inches in Circumference, bound up in a little Band, 1000 of which will coſt 15 or 16 *s.* and will cover about three Square of Roofing. For laying of which they have 4 *s. per* Square.

The Price of Thatching.] Common *Thatching* is done in ſome Places for 2 *s.* 6 *d. per* Square; but in others they have 2 *s.* 8 *d.* and in others 3 *s.* and for *Thatching* with Reeds, 4 *s.*

Of meaſuring Thatching.] Thatching is meaſured as *Tileing*, *i. e.* by the Square; and in ſome Places they are allow'd ſo many Feet more, as the Corners and Gables are Feet in Length. In other Places they are allow'd only ſo many half Feet more to the whole, as the Gables Ends are Feet in Length; the Reaſon they give for this Cuſtom, is, becauſe they have more Trouble in turning the Straw (at the Gable) that it may be cut as it is at the Eaves.

If one Side of a Roof only be

be thatch'd, and not the other, they (then) take their Dimensions over the Ridging, as far as the new Straw goes.

THEATRE } a publick E-
THEATER } difice, for the exhibiting of Spectacles or Shews to the People.

These comprehended not only the Eminence whereon the Actors appear'd, and the Action pass'd; but also the whole Area or Extent of the Place, common to the Actors and Spectators.

In this Sense, the Theatre was a Building, encompass'd with Portico's, and furnish'd with Seats of Stone, dispos'd in a Semi-Circle, and ascending by Degrees over one another, which encompass'd a Space, call'd the *Orchestra*, in the Front of which was the *Proscenium* or *Pulpitum*, on which the Actors perform'd, and which is what is by us properly call'd the *Theatre* or *Stage*.

On the *Proscenium* stood the *Scena*, a large Front, adorn'd with Orders of Architecture, behind which was the *Postcenium* or Place, where the Actors made themselves ready, retir'd, &c. so that the *Scena* in its full Extent comprehended all the Part belonging to the Actors.

The most celebrated Theatres of Antiquity remaining, are that of *Marcellus*, and of *Pompey*, which are call'd Amphitheaters.

THEATER } [among the
THEATRE } *Moderns*] is the Stage or Place whereon the Drama or Play is exhibited, which answers to the Scene of the Ancients.

And in its largest Sense, includes the whole Play-House, *i. e.* a spacious Hall or Room; part of which is taken up by the *Scena*, which includes the Stage, the Decorations and Machines of the Stage; and the Remainder Part, which is distributed into a Space call'd the Pit, which is covered with Seats, Boxes, &c. and an Elevation of one or two Galleries, dispos'd into Benches, rising or ascending one above another.

THEATRE [in *Architecture*] is chiefly us'd by the *Italians* for an Assemblage of several Buildings, which by a happy Disposition and Elevation, represents an agreeable Scene to the Eye.

As that of the Vineyards at *Rome*; that particularly of *Monte Dragone* in *Frescati*, and the new Castle of St. *Germains en Lay* in *France*.

THEODOLYTE, an Instrument us'd in Surveying and taking Heights and Distances.

THEOREM, is a Speculative Proposition, demonstrating the Properties of any Subject.

THEOREM [with *Mathematicians*] signifies a Proposition, which terminates in Theory; and which considers the Properties of Things already made or done. Or it is a Theoretical Proposition, which is deduc'd from several Definitions compar'd together.

Thus if a Triangle be compar'd with a Parallelogram, standing on the same Base, and of

of the ſame Altitude; and partly from their immediate Definitions, and partly from other of their Properties already determin'd, 'tis inferr'd that the Parallelogram is double the Triangle; that Propoſition is a Theorem.

There are two Things in every *Theorem* chiefly to be regarded, *viz.* the *Propoſition* and the *Demonſtration.* In the firſt is expreſs'd what agrees to ſome certain Thing, under certain Conditions, and what does not.

In the latter, the Reaſons are laid down, by which the Underſtanding comes to conceive, that it either does or does not agree thereto.

Theorems are of various Kinds: *Univerſal Theorems*, are thoſe which extend to any Quantity, without Reſtriction, univerſally, as this, that *the Rectangle of the Sizes and Difference of any two Quantities is equal to the Difference of their Squares.*

Particular Theorems, are ſuch as extend only to a particular Quantity.

Negative Theorems, are ſuch as expreſs the Impoſſibility of any Aſſertion; as *that the Sum of any two biquadrate Numbers cannot make a Square.*

Local Theorems are ſuch as relate to a Surface; as that *Triangles of the ſame Baſe and Altitude, are equal.*

Plane Theorems are ſuch as either relate to a Rectilinear Surface, or to one terminated by the Circumference of a Circle; as that *all Angles in the ſame Segment are equal.*

Solid Theorems are thoſe which conſider a Space terminated by a Solid Line, *i. e.* by any of the three Conic Sections; *ex. gr. this*; *that if a Right Line cut two Aſymptotick Parabola's, it's two Parts terminated by them, ſhall be equal.*

Reciprocal Theorems are thoſe whoſe Converſe is true; as that *if a Triangle have two equal Sides, it muſt have two equal Angles*, the Converſe of which is true, *that if it has two equal Angles, it muſt have two equal Sides.*

THEORETICK
THEORETICAL
THEORICK } Relating to Theory, or terminating in Speculation; in which Senſe the Words ſtands in Oppoſition to Practical.

THIMBLES. See *Iron.*

THIRD POINT
TIERCE POINT } [in *Architecture*] is the Point of Section in the Vertex of an equilateral Triangle.

Arches or Vaults of the third Point, which the *Italians* call *de terzo acuto*, are ſuch as conſiſt of two Arches of a Circle meeting in an Angle at the Top.

THOROUGH *Framing.* See *Framing.*

THOROUGH *lighted* Rooms are ſaid to be thorough lighted, when they have Windows at both Ends.

THROAT [in *Architecture.*] See *Gorge* and *Gula.*

TIGE [in *Architecture*] a Term us'd by the *French* for the

the Shaft or Fust of a Column; comprehended between the Astragal and the Capital.

TILES [in *Building*] are a Sort of thin, factitious or artificial Stones, [of a laminated Figure] us'd in the Roofs of Houses, *&c.*; but more properly they are a kind of fat clayey Earth, knodden and moulded together, of a just Thickness, dry'd and burnt in a Kiln, like a Brick, and us'd in the Covering of Houses, *&c.*

Mr. *Leybourn* says, that *Tiles* are made of better Earth than Brick Earth, and something nearer a-kin to Potters Earth.

According to the Statute 17 of *Edw.* IV. the Earth for *Tiles* should be cast up before the 1*st* of *November*, shired and turned before the 1*st* of *February*, and not made into *Tiles* before the 1*st* of *March*; and ought to be try'd and sever'd from Stones, Marl and Chalk.

There are various kinds of *Tiles*, for the various Uses in Building, and those known by several Names, as *Plain*, *Thack*, *Ridge*, *Roof*, *Crease*, *Gutter*, *Pan*, *Crooked*, *Flemish*, *Corner*, *Hip*, *Dorman*, *Dormar*, *Scallop*, *Astragal*, *Traverse*, *Paving* and *Dutch* Tiles.

Plain or Thack Tiles are those in common Use for the Covering of Houses: they are of an oblong Figure, being squeez'd flat, while they are soft.

As to their Dimensions] By the Stat. 13 of *Edw.* IV. are to be $10\frac{1}{2}$ Inches long, 6 broad, and half an Inch and half a quarter thick at least; but these Dimensions are not strictly kept to.

But in *Sussex*, a certain Author tells us, he finds them to be of different Dimensions; some 10 Inches long, $6\frac{3}{4}$ broad, and $\frac{5}{8}$ of an Inch thick; others but $9\frac{1}{2}$ Inches long, $5\frac{3}{4}$ broad, and about $\frac{1}{2}$ an Inch thick.

As to the Weight.] Mr. *Leybourn* says, that one plain *Tile* weighs about two Pounds and $\frac{1}{2}$; whence 100 of them will weigh about 250 *l.* and 1000 of them, 2500 *l.*

But others say, they have found that a single *Tile* of 10 Inches long, has not weigh'd above 2 *l.* 3 Ounces, so that 100 of them, will not weigh but 220 *l.* and 1000, 2200 *l.* and one of the other Size, weigh'd about two Pounds; so that 100 of them, will weigh but 200 *l.* and 1000, 2000 *l.*

As to their Price,] they are in some Places dearer, and in some cheaper, according to the Scarcity and Plenty of Earth of which they are made, and of the Wood with which they are burnt.

Mr. *Wing* tells us, that they are from 25 to 30 *s.* *per* 1000 in *Rutlandshire*; and Mr. *Leybourn* says, 25 *s.* in *London*; but in *Sussex*, they are sold from 15 to 17 *s.* the 1000.

Ridge Tiles, *Roof Tiles*, *Crease Tiles* } are those us'd for Covering the Ridges of Houses, being made Circular Breadth-wise, like a half Cylinder.

The Dimensions.] These according to the aforesaid Statute

tute, are to be 13 Inches long, and of the same Thickness with *Plain Tiles.*

But some of them have been found to be 13 Inches long, and 16 broad, by Compass on the Outside, and in Breadth (from Side to Side) on the Inside about 11 Inches, and some not above 9 or 10 Inches.

As to their Weight.] Some of them have been found to weigh about 8 *l.* ¾, so that 100 of them will weigh 875 *l.* and 1000, 8750 *l.*

Their Price.] Mr. *Leybourn* says, five, six, or seven of these *Tiles*, are allow'd into every 1000 of *Plain Tiles*; but if bought by themselves, they are sold from 20 to 25 *s. per* Hundred, and in *Sussex*, at 2 *d. per* Piece, or else 16 *s. per* Hundred.

Hip or Corner Tiles are such as lye on the Hips or Corners of Roofs. As to their Form, they are at first made flat like *Plain Tiles*; but of a Quadrangular Figure, whose two Sides are Right Lines; and two Ends, Arches of Circles, one End being a little Concave, and the other Convex; the Convex End to be about seven times as broad as the Concave End; so that they would be triangular, but that one Corner is taken off; then before they are burnt, they are bent on a Mould, Breadth-wise, like *Ridge Tiles*: They have a Hole at their narrow End, and are laid and nail'd with their narrow End upwards.

Their Dimensions.] By the Statute above-mention'd, these *Tiles* ought to be 10 In-ches ½ long, with convenien Breadth and Thickness. Bu some who have measured them say they have found them to b 10 Inches in Breadth (accordin to their Compass) at the narro End two Inches, and at th broad End, 14 Inches; an the Right-lin'd Breadth, at th broad End, about 11 Inches.

As to their Weight.] One o these *Tiles* has been found t weigh about three Pounds, an three or four Ounces.

As to their Price.] Mr. *Ley-bourn* says they are usually sol at 1½ *d.* or 2 *d. per Tile*, o from 10 to 15 *s. per* Hundred In *Sussex* they are sold for 1½ *d per* Piece, and 12 *s. per* Hun-dred.

Gutter Tiles are those whic lie in Gutters or Valleys, i Cross-Buildings. They ar made like *Corner Tiles*, onl the Corners of the broad En are turned back again wit two Wings. They have n Holes in them; but are lai the broad End upwards, wit out any nailing. They ar made in the same Mould wit *Corner Tiles*; and have th same Dimensions on the ou (or Convex) Side. Their Win are each four Inches broad, an eight long, pointing out sho of their narrow End about tw Inches.

Their Weight.] These b the Statute are of the sam Weight with *Corner Tiles*; that 100 of either of the kinds of *Tiles*, will weigh abo 321 or 322 Pounds; and 10 of them will weigh 3210, 3220 Pounds.

The

Their Price.] These are of the same Price with *Corner Tiles.*

Pan Tiles
Crooked Tiles
Flemish Tiles } are us'd in covering of Sheds, Lean-to's, and all kinds of flat-roff'd Buildings. They are in the Form of an oblong Parallelogram, as *Plain Tiles*, but are bent Breadth-wise, forwards and backwards in Form of an S, only one of the Arches is at least three times as big as the other, which biggest Arch is always laid uppermost; and the lesser Arch of another *Tile* lies over the Edge of the great Arch of the former.

They have no Holes for Pins, but hang on the Laths by a Knot of their own Earth.

As to their Dimensions,] they are usually 14 Inches and ½ long, and 10½ broad.

Their Price in most Places is about 7 or 8 *s.* the Hundred.

Dormar
Dorman } These *Tiles* consist of a *Plain Tile*, and a triangular Piece of a *Plain Tile*, standing up at right Angles to one Side of the *Plain Tile*, and swept with an Arch of a Circle from the other End, which End terminates in a Point, or has no Breadth.

Of these Kind of *Tiles* there are two Sorts; for in some the triangular Piece stands on the right, and in others, on the left Side of the *Plain Tile*; and of each of these again, there are two Kinds; some having a whole *Plain Tile*; others but half a *Plain Tile*: but in them all the *Plain Tile* has two Holes for the Pins at that End, where the broad End of the triangular Piece stands.

Their Use.] They are laid in the Gutters between the Roof and the Cheeks or Sides of the Dormers; the *Plain Tile* Part lying upon the Roof, and the triangular Part, standing perpendicularly by the Cheek of the Dormar.

They are excellent for keeping out the Wet in those Places, and yet not perhaps known any where but in *Sussex*.

As to their Dimensions] The Dimensions of the *Plain Tile* Part, are the same with those of a *Plain Tile*, and the triangular Part is of the same Length; and its Breadth, at one End seven Inches, and at the other, nothing.

Their Weight.] One of these *Tiles* is found to weigh about 4½ Pounds, whence 100 of them will weigh 450 Pounds, and 1000 of them, 4500 Pounds.

Their Price.] They are usually sold at 1½*d.* or 2 *d.* *per* Piece, or 12 or 16 *s.* *per* 100.

Scallop Tiles
Astragal Tiles } are in all Respects like *Plain Tiles*, only their lowers Ends are in Form of an *Astragal*: *viz.* a Semi-Circle with a Square on each Side. They are us'd in some Places for Weather Tileing, and look very handsome.

Traverse Tiles; are a Sort of irregular *Plain Tiles*, having the Pin-Holes broken out, or one of the lower Corners broken off. These are laid with the broken Ends upwards, upon

Rafters, where pinn'd *Tiles* cannot hang.

Paving Tiles. These are by some call'd *Paving Bricks.* See *Bricks.*

Flemish Tiles } are of two
Dutch Tiles } Sorts, ancient and modern. The ancient *Dutch Tiles* were us'd for Chimney Foot Paces; they were painted with Antick Figures, and frequently with Postures of Soldiers, sometimes with Compartments, and sometimes with Moresque Devices; but fell far short, both as to the Design, and the Colours of the Modern ones.

The Modern *Flemish Tiles* are commonly us'd plaster'd up in the Jaumbs of Chimneys, instead of Chimney Corner-Stones. These *Tiles* are better glaz'd, and such as are painted (for some are only white) are done with more curious Figures, and more lively Colours than the ancient ones.

But both these Sorts seem to be made of the same whitish Clay, as our white glaz'd Earthen Ware; the modern ones are commonly painted with Birds, Flowers, &c. and sometimes with Histories out of the *New Testament.*

Their Dimensions.] The ancient ones are five Inches $\frac{1}{4}$ square, and about $\frac{3}{4}$ of an Inch thick. The Modern *Flemish Tiles* are $6\frac{1}{2}$ Inches square, and $\frac{3}{4}$ of an Inch thick.

As to their Weight.] The ancient Sort weigh $1\frac{1}{4}$ of a Pound, whence 100 of them will weigh 125 Pounds, and 1000, 1250 Pounds.

The modern ones weigh a- bout one Pounds, three Ounce whence 100 will weigh 16 Pounds, and 1000, 1690 Pound

The Price of making an burning Tiles] according Mr. *Leybourn* is usually 2 *s.* 2 *s.* 6 *d. per* 1000; but som Workmen say, that for Castin the Clay, Shiring it and makin it into *Tiles* and burning t *Tiles*, they have 6 *s. per* Tho sand.

How many Tiles will cover Square.] This varies accordi to the different Width th give for the Laths.

At $6\frac{1}{2}$ Inches Gage, 740 *Ti* will cover a Square.

At 7 Inch Gage, 690; at Inch Gage, 640, and at 8 In Gage, 600 *Tiles* will cover Square, or 100 Superfic Feet.

These Numbers, suppose t Breadth of the *Tiles* to be Inches; for (if they are S tute Tiles) they will be the about when they are burnt, lowing $\frac{1}{4}$ of an Inch for th shrinking in burning.

If the *Tiles* are broader t six Inches, then a less Num will cover a Square; bu they are narrower, there m be more of them.

Tileing.

By Tileing is meant the vering of a Roof of a Buil with Tiles.

Tileing is measured the Square of 10 Feet, as Fl ing, Partitioning and Ro were in the Carpenters W so that there will not be m

D

 T I

Difference between Roofing and Tileing. For Bricklayers sometimes will require to have double Measure for Hips and Vallies.

When Gutters are allow'd double Measure, the Way is to measure the Length along the Ridge-Tile, and by that Means the Measure of the Gutters becomes double; it is also usual to allow double Measure at the Eaves, so much as the Projecture is over the Plate, which is commonly about 18 or 20 Inches.

Example 1. There is a Roof cover'd with Tiles, whose Depth on both Sides (with the usual Allowance at the Eaves) is 37 Feet, 3 Inches, and the Length 45 Feet; how many Squares of Tileing are contain'd in it?

F.	I.
37	3
45	0
185	
148	
11	3
16 | 76	3

37.25
45
18625
14900
16 | 76.25

Answer, 16 Squares, 76 Feet.

Example 2. There is a Roof cover'd with Tiles whose Depth on both Sides (with the Allowance at the Eaves is 35 Feet, 9 Inches, and the Length 43 Feet, 6 Inches. How many Squares of Tileing are in the Roof?

F.	I.	
43	6	
35	9	
215		
129		
21		
10 :	10 :	6
17	6	
15 | 15	1	6

35.75
43 5
71875
10725
14300
15 | 55.125

Here the Length and Depth being multiply'd together, the product is 1555 Feet; which divided by 100 (as is before taught) the Answer is, 15 Squares, 55 Feet.

By

By Scale and Compasses.

In the first Example, extend the Compasses from 1 to 37.25, and that Extent will reach from 45 to 16 Square, and a little above three quarters of a Square.

In the second Example, extend the Compasses from 1 to 35.75, and that Extent will reach from 43.5, to 15 Squares and 55 Feet.

The Price of Tileing.] Tileing in new Work (Mr. *Leybourn* says) and the Workman finding all Materials, as Tiles, Mortar, Laths and Nails, is usually valued at 30 *s.* or 32 *s. per* Square.

Mr. *Hatton* reckons but 28 *s. per* Square.

And for ripping of old Work, and new covering and making good the old, they reckon 12 or 14 *s.* the Square, according as they find the old Tileing.

But for Workmanship only, they reckon at *London*, 5 *s. per* Square; but in the Country, the Price is various.

Mr. *Wing* says, 3 *s.* in *Rutland*, and in some Places 2 *s.* 6 *d.*

In *Sussex* it is usually done for 3 *s. per* Square, and some say that it is done for 2 *s.* 6 *d.* in some Parts of *Kent*; but then their Tiles are large, and they Lath wide at eight Inch Gages, and pin but half their Tiles, they laying the other half traverse.

And for ripping and healing again (only) Workmanship, *Sussex* Bricklayers reckon 3 *s.* 6 *d. per* Square; and if they Counter-lath it, then 3 *s.* 9 *d.* or 4 *s.*

But in some Parts of *Kent* they Rip and Heal and Counter-lath for 3 *s. per* Square which is very cheap, but the it is suppos'd they do thei Work accordingly.

What Number of Laths an Nails go to a Square of Tileing See the Articles *Laths* an *Nails.*

The Mortar that is us'd in Square of Tileing.] The Quan tity is ¼ of as much Mortar as allow'd to a Rod of *Brick work*, will do for a Square Tileing.

The Number of Pins to Square.] Mr. *Leybourn* say they usually allow a Peck Tile Pins (from 2 *s.* 4 *d.* t Bushel) to every 1000 of Tile yet some say they use but bout a Peck to three Square Healing, which at 7 Inch Ga is more than enough for 20 Tiles.

To lay Tiles without Morta &c. *i. e.* laying them dry, they come from the Kiln.

Some lay them in a Sort Mortar, made with Loam a Horse-Dung.

In some Parts of *Kent*, th have a Way of laying Tiles *Moss*, which when the Wor men get themselves, they a allow'd 2 *d.* in a Square t more for their Work.

Some do not approve of t Way of Tileing with Mo because, they say, that in w dy, wet Weather, when t Rain, Snow or Sleet is driv under the Tiles (in the Mo if there follows a Frost, wh the Moss is wet, it then free and raises the Tiles out of th Places.

Ti

Tileing with Pan-Tiles.] These Tiles are for the most Part laid dry, without Mortar, yet sometimes pointed withinside.

The Laths on which they hang, are 10 or 12 Feet in Length, and about an Inch and half in Breadth.

They are usually sold at 2 *d.* or 3 *d.* the Lath, or at 10 or 13 *s.* the Hundred.

The Gage for nailing on these Laths (with 4 *d.* Nails) is 10 Inches and a half, and the Breadth of a Tile when laid, is eight Inches; so that about 170 will cover a Square (or 100 Foot) of this Kind of Tileing.

A great Covering with these spends but little Mortar (if pointed) and but little Time in laying.

Mr. *Wing* reckons it worth 1 *s.* 8 *d.* *per* Square laying.

A TABLE, *Shewing the Price or Value of any Number of odd Feet of* Tileing, Slateing, Roofing, Flooring, &c *which is done by the Square of ten Foot, from one Foot to twenty five, or quarter of a Square; and at any Price, from Two Shillings and Six-pence, to five Pound the Square.*

The Price of	s.	d.	s.	d.	s.	d.	s.	d.
Square			6	0	7	0	8	0
¾ Square	3	9	4	6	5	3	6	0
½ Square	2	6	3	0	3	6	4	0
¼ Square	1	3	1	6	1	9	2	0

The Price of any Number of Feet under 25 Feet, or a quarter of a Square.

	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q
1	0	0	3	0	0	3	0	0	3	0	1	0
2	0	1	1	0	1	0	0	1	3	0	1	0
3	0	1	3	0	1	3	0	2	2	0	2	2
4	0	2	1	0	2	1	0	3	1	0	3	3
5	0	3	0	0	3	0	0	4	0	0	4	3
6	0	3	3	0	3	3	0	5	0	0	5	3
7	0	4	0	0	4	2	0	5	3	0	6	3
8	0	4	3	0	5	1	0	6	2	0	7	3
9	0	5	2	0	6	0	0	7	1	0	8	3
10	0	6	0	0	6	3	0	8	1	0	9	2
11	0	6	3	0	7	2	0	9	0	0	10	2
12	0	7	1	0	8	1	0	9	3	0	11	2
13	0	7	3	0	9	0	0	10	2	1	0	1
14	0	8	2	0	9	3	0	11	1	1	1	2
15	0	9	0	0	10	2	1	0	0	1	2	1
16	0	9	2	0	11	1	1	1	0	1	3	0
17	0	10	1	1	0	0	1	1	3	1	4	1
18	0	10	3	1	0	3	1	2	2	1	5	0
19	0	11	2	1	1	2	1	3	2	1	6	1
20	1	0	0	1	2	1	1	4	1	1	7	0
21	1	0	3	1	3	0	1	5	0	1	8	1
22	1	1	0	1	3	3	1	5	3	1	9	0
23	1	1	3	1	4	2	1	6	2	1	10	1
24	1	2	1	1	5	1	1	7	3	0	11	0

The Price of the	s.	d.	s.	d.	s.	d.	s.	d.
Square	9	0	10	0	11	0	12	0
¾ Square	6	9	7	6	8	3	9	0
½ Square	4	6	5	0	5	6	6	0
¼ Square	2	3	2	6	2	9	3	0

The Price of any Number of Feet, under 25, or ¼ of a Square.

	s.	d.	q.	s.	d.	q.	s.	d.	q.	s.	d.	q.
1	0	1	0	0	1	2	0	1	2	0	1	2
2	0	2	1	0	2	1	0	2	1	0	2	0
3	0	3	1	0	3	2	0	3	2	0	3	2
4	0	4	1	0	4	3	0	4	2	0	4	2
5	0	5	2	0	6	0	0	6	0	0	6	0
6	0	6	2	0	7	1	0	7	2	0	7	2
7	0	7	2	0	8	1	0	8	2	0	9	0
8	0	8	3	0	9	2	0	10	2	0	10	0
9	0	9	3	0	10	3	0	11	2	1	0	0
10	0	10	3	1	0	0	1	0	3	1	1	2
11	1	0	0	1	1	1	1	2	1	1	3	0
12	1	1	0	1	2	1	1	3	2	1	4	2
13	1	2	0	1	3	2	1	4	3	1	6	0
14	1	3	0	1	4	3	1	6	1	1	7	2
15	1	4	1	1	6	0	1	7	2	1	9	0
16	1	5	1	1	7	1	1	8	3	2	1	2
17	1	6	1	1	9	1	1	10	1	2	1	0
18	1	7	2	1	9	2	1	11	2	2	1	2
19	1	8	2	1	10	3	2	1	0	1	3	0
20	1	9	2	2	0	0	2	2	1	1	4	1
21	1	10	3	2	1	1	2	3	3	6	6	0
22	1	11	3	2	2	1	2	4	3	1	7	2
23	2	0	3	2	3	2	2	6	1	2	9	0
24	2	1	0	2	4	3	2	7	2	2	10	2

The

The Price of the	s.	d.		s.	d.		s.	d.		s.	d.		l.	s.
Square	13	0		14	0		20	0		30	0		2	10
¾ Square	9	9		10	6		15	0		22	6		1	17
½ Square	6	6		7	0		10	0		15	0		1	5
¼ Square	3	3		3	6		5	0		7	6		0	12
The Price of any Number of Feet, under 25, or quarter of a Rod.	**s.**	**d.**	**q**	**s.**	**d.**	**q**	**s.**	**d.**	**q.**	**s.**	**d.**	**q.**	**s.**	**d.**
1	0	1	3	0	1	2	0	2	2	0	3	3	0	5
2	0	3	1	0	3	2	0	4	3	0	7	0	0	9
3	0	4	3	0	5	0	0	7	1	0	10	3	1	2
4	0	5	2	0	6	2	0	9	2	1	2	1	1	7
5	0	7	3	0	8	0	1	0	0	1	6	0	2	0
6	0	8	2	0	10	0	1	2	2	1	9	3	2	5
7	0	10	3	0	11	2	1	4	3	2	1	0	2	9
8	1	0	2	1	1	0	1	7	1	2	4	3	3	2
9	1	2	1	1	2	2	1	9	2	2	8	1	3	7
10	1	3	2	1	4	2	2	0	0	3	0	0	4	0
11	1	5	1	1	6	0	2	2	2	3	3	3	4	5
12	1	6	3	1	7	2	2	4	3	3	7	0	4	9
13	1	8	0	1	9	0	2	7	1	3	10	3	5	2
14	1	10	0	1	10	2	2	9	2	4	2	1	6	7
15	1	11	1	2	0	0	3	0	0	4	6	0	6	0
16	1	0	2	2	2	0	3	2	2	4	9	3	6	5
17	1	2	2	2	3	2	3	4	3	5	1	0	6	9
18	1	3	3	2	5	0	3	7	1	5	4	3	7	2
19	2	5	3	2	7	0	3	9	2	5	8	1	7	7
20	2	7	0	2	8	2	4	0	0	6	0	0	8	0
21	2	9	0	2	10	0	4	2	2	6	3	3	8	5
22	2	10	0	2	11	2	4	4	3	6	6	0	8	9
23	3	0	0	3	1	0	4	7	1	6	10	3	9	2
24	3	1	1	3	3	2	4	9	2	7	2	1	9	7

The Explanation of the fore-ing TABLE.

First, In the Head of the able, you have the Price of e Square; $\frac{3}{4}$ of a Square; of a Square, and $\frac{1}{4}$ of a uare, placed over each Co-mn, calculated from 5 *s.* the uare, to 40 *s.* the Square; d by Addition, to 5 *l.* &c. r Square.

Secondly, In the first Column u have any Number of odd eet under 25; and in the other Columns, the Price or Rate of any Number of odd Feet, according to the Rate or Price, at the Head of the Column.

The Manner of using the Table *is as follows.*

Look for the Price at the Head of the Table, and under it you will find the Price of $\frac{3}{4}$ of a Square; $\frac{1}{2}$ a Square, and $\frac{1}{4}$ of a Square, and against the odd Feet, their respective Prices.

EXAMPLE I.

hat are the Prices of $\frac{3}{4}$ of a Square, $\frac{1}{2}$ a Square, and $\frac{1}{4}$ of a Square, and 18 Feet, at 14 *s.* *per* Square?

	l.	*s.*	*d.*
The Square is - - - - - - -	00 :	14 :	00
The $\frac{3}{4}$ of a Square - - - - - -	00 :	10 :	06
The $\frac{1}{2}$ of a Square - - - - -	00 :	07 :	00
The $\frac{1}{4}$ of a Square - - - -	00 :	03 :	06
The 18 Feet - - - - - - - -	00 :	02 :	05
The Sum is	01 :	03 :	05

EXAMPLE II.

What comes 22 Feet to, at 13 *s.* *per* Square?

Against 22 Feet in the first lumn, and under 13 *s.* at Head of the Table, is 2 *s.* 10 *d.* which is the Price or Value of 22 Feet, at 13 *s.* *per* Square.

EXAMPLE III.

What comes 24 Feet to, at 1 *l.* 16 *s.* the Square?

In the upper Part of the Ta-, you cannot find 36 *s.* but you may find 30 *s.* in one Column, and 6 in another.

24 Feet at 30 *s.* is 7 *s.* $2\frac{1}{4}$ *d.* 24 Feet at 6 *s.* is 1 *s.* $5\frac{1}{4}$ *d.* that 24 Feet at 36 *s.* *per* Square, comes to

s.	*d.*
7 :	$2\frac{1}{4}$
1 :	$5\frac{1}{4}$
8 :	$7\frac{1}{2}$

EXAMPLE IV.

What comes 15 Feet to, at 3 *l.* 19 *s.* *per* Square?

	l.	*s.*	*d.*
15 Feet at 40 *s.* *per* Square, is - -	0 :	6 :	0
15 Feet at 30 *s.* *per* Sqnare, is - -	0 :	4 :	6
15 Feet at 9 *s.* *per* Square, is - -	0 :	1 :	$4\frac{1}{4}$
The Sum is	0 :	11 :	$10\frac{1}{4}$

EXAMPLE V.

What does 23 Feet come to, at 1 *l.* 12 *s.* 6 *d.* *per* Square?

	l.	*s.*	*d.*
23 Feet at 20 *s.* *per* Square, is - -	0 :	4 :	$7\frac{1}{4}$
23 Feet at 10 *s.* *per* Square, is - -	0 :	2 :	$3\frac{1}{2}$
23 Feet at 5 *s.* 6 *d.* *per* Square, is 1 *s.* 1 *d.* whose half is - -	0 :	0 :	$6\frac{1}{2}$
The Sum is	0 :	7 :	$5\frac{1}{4}$

TIMBER includes all kind of fell'd and season'd Woods; or those kind of Trees, which being cut down and season'd, are us'd in the several Parts of a Building, by the *Carpenter*, *Joiner*, *Turner*, *&c.*; these when cut down, are call'd *Timber*, and when growing, *Timber Trees*.

The Kinds of Timber are so numerous, that it would be tedious to mention them all. I shall content my self with mentioning the most common kinds of Timber, and their Uses, as they are found down in Mr. *Evelyn*'s *Sylva* and Mr. *Worlidge*'s *Systema Agriculturæ*.

1. *Oak.* The several Uses of oaken Timber for Building and other Mechanick Uses, are so universally known, that it would be needless to ennumerate them.

There is no Wood comparable to it, for enduring all Seasons and Weathers; as for Pales, Shingles, Posts, Rails, Boards, *&c.* For Water Works it is second to none, especially wh

lies expos'd to the Air as ll as the Water, there is ne equal to it.

2. *Elm*; if it be fell'd be- een *November* and *February*, ll be all Spine or Heart, and her none or very little Sap, d is of most singular Use (in Water) where it lies always t; and also where it may always dry. Also the ughness of it, renders it of eat Use to Wheel-wrights, ll-wrights, &c. it is also good Dressers and Planks to chop , because it is not liable to eak and fly away in Chips, e other Timber.

3. *Beech*; its chief Use is in nery, Turnery, Upholstery, d the like Mechanical Works; e Wood being of a white d fine Grain, and not apt to nd or slit: yet it is sometimes 'd (especially of late Years) Building Timber, and if it s always wet (as in Ground ts and the like) it is judg'd, at it will outlast even Oak elf.

4. *Ash*; the Use of *Ash* is most universal. It is good Building or other Occasions, ere it may lie dry: it serves Carpenter, Cooper, Tur- , Plough-wright, Wheel- ight, &c. and for Garden s, no Wood exceeds it; as Ladders, Hop-Poles, Pali- e-Hedges, &c. and also at , for Oars, Hand-Spikes, &c.

5. *Fir*; which is commonly own by the Name of *Deal*, is of late much us'd in ilding, especially within ors, for Stairs, Floors, Wain- , and most ornamental Works.

6. *Walnut-Tree Timber* is of universal Use, excepting for the outside of Buildings: there is none better for the Joiner's Use, it being of a more curious brown Colour than Beach, and not so subject to the Worms.

7. *Chesnut Tree*: The Timber of this Tree is next to *Oak*, and is the most sought after by the Joiner and Carpenter, and is of very long lasting, as appears by many ancient Houses and Barns, built of it, about *Gravesend*, in *Kent*.

8. The *Service Tree*: The Timber of this Tree is useful for the Joiner, it being of a very delicate Grain, and is fit for divers Curiosities. It also affords Beams of a considerable Bigness for Building.

9. The *Poplar*, *Abel and Aspen*; which Kinds of Timber are very little different from one another, and of late, are much us'd instead of *Fir*; they look well, and are tougher and harder.

10. *Alder* is useful for the Poles of Ladders and Scaffolds, and also for Sewers and Pipes, for Conveyance of Water; for if it lie always wet, it will harden like a Stone it self; but where it is sometimes wet, and sometimes dry, it rots immediately.

11. *Lime-Tree*: Of this have been made Ladders, which have been excellently good, and of a very great Length.

The Time of felling Timber.

The Season of felling Timber, usually commences about the

the End of *April* (because at that Time, the Bark generally rises the most freely, and if there be any Quantity of Timber to be fell'd, the Statute obliges to fell it then, the Bark being necessary for the Tanner.

But the Opinions and Practices of Authors have been very different concerning the best Time to fell Timber.

Vitruvius recommends an autumnal Fall: others advise *December* and *January*: *Cato* was of Opinion, that Trees should have bore their Fruit before they were fell'd, at least their Fruit should be first ripe, which falls in with the Sentiment of *Vitruvius*.

And indeed tho' Timber unbark'd, be most obnoxious to the Worm, yet we find the wild Oak, and Timber fell'd too late, when the Sap begins to be proud, to be very subject to Worms; whereas being cut about Mid-Winter, it neither casts, rifts or twines, because the Cold of the Winter does both dry and consolidate it.

It would be happy therefore for our Timber, if a Method of tanning without so much Bark, could be found out, as the Honourable Mr. *Charles Howard* has most ingeniously offer'd, were become universal, that Trees being fell'd more early, the Timber might be fell'd more early, so as to be better season'd and condition'd for its various Uses.

The Ancients had a great Regard to the Age of the Moon, in felling their Timber, and the Presence of *Diana* in *Sylvis* or the Woods, was n so much celebrated to cre the Fictions of the Poets, for the Dominion of that mo Planet, and her Influence up Timber.

If their Rules avail a Thing, they are these: F Timber in the Wane or D crease, or four Days after t New Moon; and some advi that it be in the last Quart *Pliny* advises, that it be in t very Article of the Chang which happening in the ve last Day of the Winter-S stice (he says) that Timber w prove immortal.

Columella says, from the 2c to the 30th Day: *Cato* sa four Days after the Full: *V getius* says, from the 15th to t 25th for Ship Timber; b never in the Increase, Tre then abounding with Moistu which is the only Source Putrefaction.

Some have Regard even the Temper and Time of t Day, the Wind to be low, ne ther East nor West; neith in frosty, wet or dewy We ther, and therefore never the Forenoon.

Lastly, Regard is to be h to the Species of Timber. is best to fell Fir, when it b gins to spring; both as it th quits its Coat best, and as t Wood (according to *Theophr stus*, is by that Means render wonderfully durable in Wate

Elm, says Mr. *Worlidge*, is be fell'd between *Novemb* and *January*; in which C it will be all Heart; at le the Sap will be very incon derabl

rable: He adds, that this is e only Season for felling *Ash*. me Authors advise in the lling of Timber, to cut it t into the Pith, and so to let stand till dry; by which eans the Moisture is evacu- d in Drops, which would herwise cause Putrefaction.

The Method of Seasoning Timber.

After Timber has been fell'd d sawn, it is next to be sea- 'd; for the doing of which me advise that it be laid up y dry in an airy Place, yet t of the Wind and Sun, at e least, free from the Extre- ties of either; and that it ayn't decay, but dry evenly, y order that it be daub'd r with Cow Dung.

Let it not stand upright, but it along, one Piece upon other, only kept a-part by rt Blocks interpos'd, to pre- t a certain Mouldiness, ich they are apt to contract sweating one upon another; ich frequently produces a ngus, especially if there be 'sappy Parts remaining.

Others advise to lay Boards, nks, &c. in some Pool or ning Stream for a few Days, extract the Sap from them, afterwards to dry them in Sun or Air. They say, by this Means, they will her chap, cast, nor cleave. Evelyn particularly com- ds this Way of Seasoning Fir. Against shrinking there o Remedy.

ome again advise to bury them in the Earth; others in Wheat; and others are for scorching and seasoning them in Fire, especially Piles, Posts, &c. that are to stand, either in Water or Earth.

Sir *Hugh Plat* informs us, that the *Venetians* burn and scorch their Timber in the flaming Fire, continually turning it round with an Engine, till it has got a hard, black, crusty Coal upon it. And the Secret carries great Probability with it, for that the Wood is brought by it to such a Hardness and Drieness, that neither Earth nor Water can penetrate it.

Mr. *Evelyn* tells us, that he himself had seen Charcoal dug out of the Ground, amongst the Ruins of ancient Buildings, which in all Probability had lain covered with the Earth for near 1500 Years.

Of preserving Timber.

When Timber or Boards, &c. have been well season'd or dry'd in the Sun or Air, and fix'd in their Places, and what Labour you intend is bestow'd upon them, Care is to be taken to defend and preserve them, to which the smearing them with Linseed Oil or Tar, or the like oleaginous Matter, contributes much to their Preservation and Duration.

Hesiod prescribes to hang your Instruments in the Smoke to make them strong and lasting; if so, surely the Oil of Smoke (or the vegetable Oil by some other Means obtain'd) must

must needs be effectual for the Preservation of Timber.

The Practice of the *Hollanders* deserves our Notice, who, to preserve their Gates, Port Cullis's, Draw-Bridges, Sluices, &c. coat them over with a Mixture of Pitch and Tar, whereon they strew small Pieces of Cockles and other Shells, beaten almost to Powder, and mix'd with Sea Sand; which incrust and arm it wonderfully against all Assaults of Wind and Weather.

When Timber is fell'd before the Sap is perfectly at rest, it is very subject to the Worms; but to prevent and cure this, Mr. *Evelyn* recommends the following Secret, as the most approv'd.

Put common Sulphur into a Cucurbit, with as much *Aqua Fortis* as will cover it three Fingers deep; distil it to a Drieness, which is perform'd by two or three Rectifications.

Lay the Sulphur that remains at the Bottom, being of a blackish or sad red Colour, on a Marble, or put it in a Glass, and it will dissolve into an Oil; with this Oil anoint the Timber which is infected with Worms, or to be preserv'd from them.

It is a great and excellent *Arcanum* (he tells us) for tinging the Wood of no unpleasant Colour, by no Art to be wash'd out; and such a Preservative of all Manner of Woods, nay of many other Things also; as Ropes, Cables, Fishing-Nets, Masts of Ships, &c. that it defends them from Putrefaction, either in Water, under, or a the Earth; in Snow, Ice, *Winter* or *Summer*, &c.

It were superfluous to scribe the Process of ma the *Aqua fortis*; it shall fice to let you know, that common *Copperas* makes *Aqua fortis* well enough our Purpose, being drawn by a Retort. And as for *phur*, the Island of St. *Chr phers* yields enough (w hardly needs any refining) furnish the whole World.

This Secret for the curio thought not proper to o tho' a more compendious may serve the Turn, thre four anointings, as to Posts, this has been experimente a Walnut Tree Table, w it has destroy'd Million Worms immediately, and to be practis'd for Ta Tubes, Mathematical In ments, Boxes, Bed-Ste Chairs, &c. the Oil of W nuts will doubtless do the sa is sweeter and better than nish; but above all, Oil of dar, or that of Juniper is c mended.

As for Posts or the like t stand in the Ground, the bu ing the Outsides of those E that are to stand in the Grou is a great Preservative.

Sir *Hugh Plat* tells us o *Kentish* Knight of his Acqu tance, who us'd to burn Ends of his Posts for Rai and Paling; and this was likew practis'd by Mr. *Walter C field* of *Sussex*, Esquire, very good Success.

And this Practice was

ba

bly deduc'd from the Obser-
tions that several made who
gged the Earth, and found
harcoal, which, as they con-
ctured, had lain there 100
ears (nay Esq; *Evylin* says
00) and yet was not in the
aft inclin'd to Putrefaction,
t was very firm and solid;
hich is a plain Demonstration,
at Timber thus prepar'd, will
sist Putrefaction much longer
an it can do without it.

That this burning the Ends
Timber, is also practised in
ermany, as appears by the
bstract of a Letter written by
avid Vanderbeck, a *German*
hilosopher and Physician at
inden, to Doctor *Largelot*,
gistred in the *Philosophical*
ransactions, N. 92. Page 585,
these Words: Hence also
ey slightly burn the Ends of
imber to be set in the
round, that so by the *Fusion*
ade by the Fire, the *volatile*
lts (which by Accession of
e Moisture of the Earth
ould easily be consum'd to
e Corruption of the Timber)
ay catch and fix one another.

f closing the Chops or Clefts in Green Timber.

Green Timber is very apt
split aud cleave after it is
rought into Form; which is
great Eye Sore in fine Build-
gs.

This may be done by anoint-
g, suppling and soaking it
ith the Fat of powdered Beef
roth, twice or thrice repeated;
d the Chaps fill'd with
punges, dipt into it; this is
to be done, as has been said,
twice or thrice over.

Some Carpenters make Use of Grease and Saw Dust, mingled together for the same Purpose; but the first is so good a Way, (says our Author) that I have seen *wind-shock'd Timber* so exquisitely clos'd, as not to be discern'd where the Defects were. But this must be done while the Timber is green.

Of measuring of Timber.

Timber is commonly measured and sold by the Tun or Load, which is a solid Measure, containing 40 or 50 solid Feet, *viz.* 40 Feet of round Timber, aud 50 Feet of hewn Timber; the Denomination of Load or Tun is suppos'd to arise from hence, that 40 or 50 solid Feet of such Timber, weighs about a Tun, *i. e.* 20 Hundred Weight, which is usually accounted a Cart Load.

1. *For measuring of Round Timber.*] The Custom is to gird the Tree about in the middle of the Length, and folding the Line twice to take one Length or a quarter of the whole, and to account that for the true Side of the Square. Then for the Length, 'tis accounted from the But-end of the Tree, so far up as the Tree will hold *half a Foot Girt*, as they phrase it, *i. e.* as long as the Line twice folded, is half a Foot.

The Dimensions thus taken, the Quantity of Timber may be measured, either, by multiplying the Side of the Square in

in it self, and that Product will be the Length by the Method of *Cross Multiplication.*

But more easily and speedily on *Gunter's Line*, by extending the Compasses from 12 to the Side of the Square in Inches; for that Extent turn'd twice (the same Way) from the Length in Feet, will reach to the Content in Feet.

But better still on *Coggleshal's* Sliding Rule, by setting 12 on the Girt Line D, to the Length of Feet in the Line C: then against the Side of the Square, on the Girt Line D, taken in Inches, you have on the Line C, the Content of the Timber in Feet.

Note 1. This Method of measuring round Timber, tho' it is common, is very erroneous; and the Content that is found hereby, 'tis demonstrated is less than the true Content or Measure in the Ratio of 11 to 14.

How to avoid this Error, and measure it justly, is shewn under the Use of *Coggleshal's Sliding Rule*. Which see.

2. If the Tree have any great Boughs or Branches that have Timber (as they phrase it) *i. e.* which will hold half a Foot Girt, they are usually measured and added to the rest: the Solidity of the whole being thus found, they divide it by 40, which brings it into Loads or Tuns.

3. In measuring Round Timber for Sale, they usually cast away an Inch out of the Squares for the Bark, if Oak; so that a Tree 10 Inches square, they reckon it as if it were but 9; but for *Ash*, *Elm* and Bea[ch] an Inch is too much to be [al]low'd for the Bark.

Again, this Way of taking [a fourth] of the Circumference for [the] true Square, is erroneous, a[nd] always gives the Solidity l[ess] than the Truth, by about [a] fifth Part.

For measuring hewn or squ[a]red Timber.] The Custom is [to] find the middle of the Leng[th] of the Tree, and there to m[ea]sure its Breadth, by clappi[ng] two Rules or other strait Thin[gs] to the Sides of the Tree, a[nd] measuring the Distance betwe[en] them; in the like Manner th[ey] measure the Breadth the oth[er] Way: If the two be unequ[al] they add them together, a[nd] take half the Sum for the tr[ue] Side of the Square.

The Dimensions thus take[n] the Content is found either [by] *Cross Multiplication*, *Gunte[r's] Scale*, or the *Sliding Rule*, a[f]ter the Manner already direct[ed], the Content divided by 5[0] gives the Number of Loads.

If the unequally, this Metho[d] of measuring it, is erroneou[s] always giving the Content mo[re] than the Truth, and the mo[re] so, as the Difference of t[he] Sides is the greater; yet Cu[s]tom has authoriz'd it, to mea[]sure such Timber justly, a mea[n] Proportional should be foun[d] between the unequal Sides and this mean be accounted th[e] Side of the Square.

The Measuring of Board and Timber.

1. *Of Board-Measure.*

To measure a Board, is no [ot]her but to measure a long [Sq]uare.

Example 1. If a Board be [16] Inches broad, and 13 Feet [lon]g, how many Feet is con[tai]n'd therein?

Multiply 16 by 13, and the [Pro]duct is 208; which divided [by] 12, gives 17 Feet, and 4 [re]mains, which is a third Part [of] a Foot.

Or thus: Multiply 156 (the [Le]ngth in Inches) by 16, and [the] Product is 2496; which di[vid]ed by 144, the Quotient is [17] Feet, and 48 remains, which [is a] third Part of 144, the same [as] before.

12 : 13 : : 16
13
——
48
16
——
12)208
——
$17 \frac{4}{12}$

Or, 144 : 156 : : 16
16
——
936
156
——
144)2496($17 \frac{48}{144}$
——
1056
——
48

By Scale and Compasses.

Extend the Compasses from 12 to 13, that Extent will reach from 16 to $17\frac{1}{3}$ Feet, the Content.

Or, extend from 144 to 156, (the Length in Inches) that Extent will reach from 16 to $17\frac{1}{3}$ Feet, the Content.

Example 2. If a Board be 19 Inches broad, how many Inches in Length will make a Foot?

Divide 144 by 19, and the Quotient is 7.58 very near; and so many Inches in Length, if a Board be 19 Inches broad, will make a Foot.

I. I. I. I.
19 : 144 : : 1 : 7.58 *fere.*

Extend the Compasses from 19 to 144, that Extent will reach from 1 to 7.58; that is, 7 Inches, and something more than a half. So, if a Board be 19 Inches broad, if you take 7 Inches and a little more than a half with your Compasses from a Scale of Inches, and run that Extent along the Board, from End to End, you may find how many Feet that Board contains; or you may cut off from that Board, any Number of Feet desir'd.

For this Purpose there is a Line upon most ordinary Joint-Rules, with a little Table plac'd upon the End of all such Numbers as exceed the Length of the Rule, as in this little Table annex'd.

0	0	0	0	5	0	8½	6
12	6	4	3	2	2	1	1
1	2	3	4	5	6	7	8

Here you ſee, if the Breadth be one Inch, the Length muſt be 12 Feet; if two Inches, the Length is 6 Feet; if five Inches broad, the Length is 2 Feet, 5 Inches, &c.

The reſt of the Lengths are expreſs'd in the Line: thus if the Breadth be 9 Inches, you will find it againſt 16 Inches, counted from the other End of the Rule; if the Breadth be 11 Inches, then a little ab 13 Inches, will be the Len of a Foot, &c.

§ 2. *Of Squar'd Timber.*

By Squar'd Timber is h meant all ſuch as have eq Baſes, and the Sides ſtrait parallel.

Example 1. If a Piece Timber be 1 Foot, 3 Inches 15 Inches) ſquare, and 18 F long, how many ſolid Feet contain'd therein?

```
                    F.   I.
      15            1    3
      15            1    3
      --            ---------
      75            1    3
     15                  3   9
     ---            ---------
     225            1    6   9
      18                     6
    1800            ---------
     225            9    4   6
                             3
 144)4050(28.125    ---------
     ----          28    1   6
     1170           ---------
     ----
      180
       360
        720
```

Anſwer, 28 Feet and half a quarter.

Here, inſtead of multiplying by 18, (where I wrought by Feet and Inches) I multiply'd by 6, and then by 3, becauſe 3 times 6 is 18.

Example 2. If a Piece of ſquar'd Timber be 2 Feet 9 Inches deep, and 1 Foot ches broad, and 16 Feet ches long, how many Fe Timber are in that Piece?

Multiply the Depth, Br and Length together, an Product will be the Conte

	F.	I.		
33	2	9		
19	1	7		
297	2	9		
33	1	7	3	
627	4	4	3	
16.75	16	9		
3135	69	8	0	
4389	3	3	2	3
3762				
627	72	11	2	3

144) 10502.25 (72.93

422
1342
465

33

Answer, 72 Feet, 11 Inches; or, 72 Feet, 93 Parts.

By Scale and Compasses.

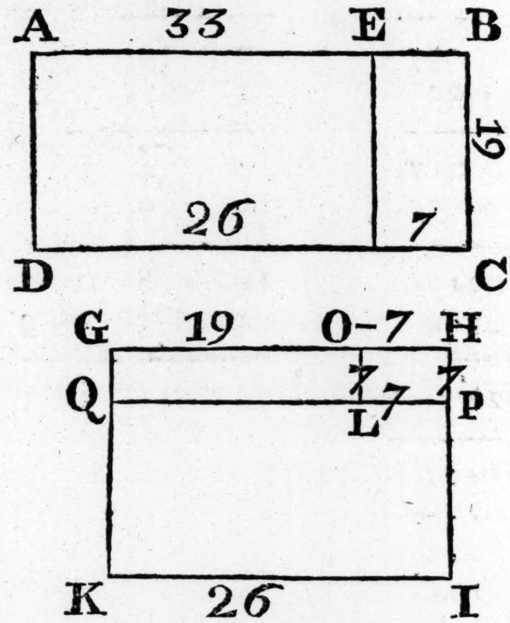
For the first Example, ex-
d the Compasses from 12 to
Inches, (the Side of the
are) that Extent will reach
n 18 Feet (the Length be-
twice turn'd over) to 28
t and something more.

For the second Example,
a mean Proportional be-
en 19 Inches and 33 Inches,
dividing the Space between
n into two equal Parts;
the Compass Point will
upon .25, which is a mean
portional between 19 and

Then extend the Compasses
n 12 to 25, (the Propor-
tional found) that Extent will reach (being twice turn'd over) from 16.75 Feet, the Length, to 72.93 Feet, the Content.

A common Error is committed, for want of Art, in measuring these last Sorts of Solids, by adding the Depth and Breadth together, and taking half for the Side of a mean Square. This Error, tho' it be but small, when the Depth and Breadth be pretty near equal; yet if the Difference be great, the Error is very considerable; for the Piece of Timber, thus measur'd, will be more than the Truth, by a Piece whose Length is equal to the Length of the Piece of

Timber to be meaſur'd, and the Square equal to half the Difference of the Breadth and Depth, as I ſhall here demo ſtrate.



I ſay, the Square G H I K, is greater than the Parallelogram A B C D, by the little Square O H P L; for the Parallelogram Q P I K, is equal to the Parallelogram A E F D; and the Parallelogram G O L Q, is equal to the Parallelogram E B C F. Therefore the Square is greater than the Parallelogram, by the little Square O H P L; which was to be prov'd.

Otherwiſe, you may prove it by Numbers, thus; the Sum of 33 and 19, is 52; the half thereof is 26; the Square of 26 is 676; and the Product the Depth and Breadth, is 6 the Difference of theſe tw 49, equal to the Square of the Difference; for the Di rence between 33 and 19 14, the half thereof is 7, wh Square is 49. Which was be prov'd.

Now, if this 49 be mu ply'd by the Length of Piece, and that Product divi by 144, to bring it to Feet, thoſe Feet added to the t Content, the Sum will be eq to the Content, found by falſe Way mention'd.

See the Work of both.

```
  33 Depth.        16.75 the Length.
  19 Breadth.         49 the Square of ½ Diff.
  ——               ————
  52 Sum.          15075
  ——               6700
  26 half.         ————
  26            4)820.75(5.69
  ——               ————
  156              1007
  52                1435
 ————              ————
 67.6                139
16.75
 ————
 3380
 4732
4056
676
 —————
144)11323.00(78.63
 —————
 1243
  910
   460
  ———
   28
```

Feet
To 72.93 the true Content,
Add 5.69 the Part superfluous.

Rem. 78.62 equal to the Content by the false Way.

By Feet and Inches.

F.	I.			
0	7			
0	7			
0	4	1		
16	9			
5	5	4		
	3	0	9	
5	8	4	9	Part superfluous.
72	11	2	3	true Content add.
78	7	7	0	equal to the Content by the false Wa

F.	I.	
2	2	
2	2	
4	4	
	4	4
4	8	4
16	9	
75	1	4
3	6	3

False C. 78 7 7

To find how much in Length makes a Foot of any squar'd Timber.

Always divide 1728 (the solid Inches in a Foot) by the Area of the Base; the Quotient is the Length of a Foot.

This Rule is general for all Timber, which is of equal Thickness from End to End, whether it be square, triangular, multangular, or round.

Example 1. If a Piece of Timber be 18 Inches square, how much in Length will make a Foot solid?

```
      18
      18
     ---
     144
      18
     ---
324) 1728 (5 1/3
     1620
     ----
      108
```

Answer, 5 Inches and $\frac{1}{3}$

By Scale and Compasses.

Extend the Compasses fro 1 to 18, that Extent will rea from 18 to 324, the Square Area of the Base; then exte from 324 to 1728, that Exte will reach down from 1 to Inches and $\frac{1}{3}$ of an Inch.

Or thus: Extend the Co passes from 18 to 41.569, th Extent turn'd twice over fro 1, will at last fall upon $5\frac{1}{3}$, before.

Note, That 41.569 is t square Root of 1728.

Example 2. If a Piece Timber be 22 Inches deep a 15 Inches broad, how mu in Length will make a Foo

```
        22
        15
      ----
       110
       22
      ----
330)1728(5.23
      ----
       780
      1200
      ----
       210
```

nswer, 5 Inches and .23 Parts.

By Scale and Compasses.

Extend the Compasses from 1 to 15, that Extent will reach from 22 to 330; then extend from 330 to 1728, that Extent will reach from 1 to 5.23 Inches, the Length of a Foot.

There is a Line for this Purpose upon most ordinary Rules, with a little Table at the End of all such Numbers as exceed the Length of the Rule, such as this annex'd.

0	0	0	0	9	0	11	3	9	Inches.
144	36	16	9	5	4	2	2	1	Feet.
1	2	3	4	5	6	7	8	9	Side of the Sq.

Here it is to be seen, that the Side of the Square be 1, Length must be 144 Feet; two Inches be the Side of Square, it must be 36 Feet Length, to make a solid ot, &c.

If the Side of the Square be in the little Table, it may found upon the Line; thus he Side of the Square be 16 hes, you will find it against nches, and 7 tenths, counted n the other End of the le.

Then, if you take the Length a Foot from the Line of In- with the Compasses, and the Compasses along the ce from End to End, you find how many Feet are ain'd in that Piece; or you cut off any Number of Inches that shall be de- ; but if the Sides of the e be unequal, then you to find a mean Proportional nber, as has been before taught, by dividing the Distance upon the Line of Numbers into two equal Parts.

Thus, if the Breadth be 25 Inches, and the Depth 9 Inches, divide the Space upon the Line of Numbers into two equal Parts, and you will find the middle Part at 15; so is 15 Inches the Geometrical mean Proportional sought; then if you look for 15 upon the Line above-mentioned, you will find 7 Inches and a little above half to be the Length of a Foot.

§ 3. *Unequal Squar'd Timber.*

Unequal squar'd Timber is all such as hath unequal Bases; *i. e.* that is thicker at one End than the other; and such the Generality of Timber Trees are, when they are hewn and brought to their Squares.

The usual Way of measuring such Timber is, to tak

a Square about the middle of the Piece, which is suppos'd to be a mean Square: This Way comes pretty near to the Truth, when the Piece is pretty near as thick at one End as at the other; but the Error is very considerable, when there is a great Disproportion between the Ends of the Piece, all such Solids being the *Frustums* of *Pyramids*; the true Way of measuring them must be by the Directions given for measuring the *Frustum* of a *Pyr*[amid]. See *Pyramid*, and *Fr*[*ustum of a Pyramid*.]

I shall give an Example [or] two, wrought both by the tr[ue] and the false way; by whi[ch] you may see the Difference.

Example 1. If a Piece [of] Timber be 25 Inches square [at] the greater End, and 9 Inch[es] square at the lesser End, a[nd] 20 Feet long, how many F[eet] of Timber are in that Tree[?]

```
      25
       9
     ----
Sum   34
     ----
Half  17 the Side of the Square in the middle.
      17
     ----
     119
      17
     ----
     289
      20
     ----
144) 5780 (40.13
     ----
      0200
       560
      ----
       128
```

Answer 40.13 Feet, by the false Way.

25	25
9	9
225	16 Difference of the Sides.
	16
	96
	16
	3)256 the Square.
	85.333
	225
	310.333
	20
	144)620.6660(43.101
	446
	146
	266
	122

Answer 43.101 Feet by the true way; so that there is near 3 Feet difference.

By Scale and Compasses.

Extend the Compasses from 1 to 9, that Extent will reach from 25 (the same way) to 225 the Rectangle of the Sides of the two Bases; then the Difference between the said Sides is 16: extend the Compasses from 3 to 16, and that Extent will reach from 16 to 85.333, a third Part of the Square; which being added to 225, the Sum is 310.333 a mean Area: then extend the Compasses from 144 to 310.333, and that Extent will reach from 20, the Length, to 43.1 Foot, the Content the true way.

Extend the Compasses from 12 to 17 (the Side of the middle Square) and that Extent will reach from 20 (the Length being twice turn'd over) to 40.1. Feet, the Content by the false way.

Example 2. If a Piece of Timber be 32 Inches broad and 20 Inches deep, at the greater End, and 10 Inches broad and 6 deep at the lesser End, and 18 Foot long, how many Feet of Timber are in that Piece?

32

```
      32
       20
      ----
      640
       60
      ----
      . . .
      38400
      1
      ----
    29)284
   385)-2300
  3909)--375000
 39185)---231900
391909)----359750

144)5375·754(37·33
    ----
     1055
      477
      455
      ---
       23
```

Answer { Content the true way 37·33 Feet. Content the false way 34.12 Feet. }

```
      6
     10
     --
     60

  195·959 mean Prop.
  640 the greater Base.
   60 the lesser Base.
  ------
  895·959 the Sum.
      6⅓ the Height.
  ------
  5375·754

Add  32         20
     10          6
     --         --
Sum  42         26 Sum.
     --         --
Half 21         13 half.
     13
     --
     63
     21
     --
    273 Area in the mid.
     18 Length.
    ----
   1284
    273
   ----
144)4914(34.12
    594
    180
    360
    ---
     72
```

By Scale and Compasses.

Extend the Compasses from 1 to 20, and that Extent will reach from 32 to 640, the Area of the greater Base.

Then extend them from 1 to 60, and that Extent will reach from 640 to 38400, the Product of the two Areas.

Find the square Root of it, by dividing the Space between 1 and 38400 into two equal Parts, and so you will find the middle Point at 195.959 the Root sought; which is a mean Proportional between the greater and lesser Areas.

Then add the mean Proportional and two Areas together, and the Sum will be 895.959; which being multiply'd by 6 (a third Part of the Length) by extending from 1 to 6, and that Extent will reach from 895.959, to 5375.75.

Then extend them from 144 to 5375.75, and that Extent will reach from 1 to 37.33 Feet the true Content.

For the false way, half the Sum of the Breadths is 21, which is the Breadth in the middle; and half the Sum of the Depths is 13: Extend the Compasses from 1 to 13, and that Extent will reach from 21 to 273, the Area of the middle Base: then extend them from 144 to 273, and that Extent will reach from 18 (the Length) to 34.12, the Content the false way.

Of measuring round Timber, whose Bases are equal.

The common way of measuring round Timber Trees, is to girt them about the middle with a String, and to take the fourth Part of that Girt for the Side of a Square, by which the Piece of Timber is measured as if it was square.

But that this is an Error, will be made appear by what follows.

If the Circumference of a Circle be 1. the Area will be .07958; then the fourth Part of 1 is .25, which being squared, makes .0625; this they suppose to be a mean Area, instead of .07958: therefore the true Content always bears such Proportion to the Content found by the said customary false way, as .07958 to .0625; which is nearly as 23 to 18; so that in measuring by that customary false way, there is above the one fifth Part lost of what the true Content ought to be.

This Error, tho' it has been so often confuted, yet it is grown so customary every where, that there is but little Hopes of prevailing with Persons to embrace the Truth; but however, I shall proceed in the following Examples to give the Operations both by the true way, and the false customary way.

Example 1. If a Piece of Timber be 96 Inches in Circumference or Girt, and 18 Feet in Length, how many Feet of Timber does it contain?

a fourth Part of 96 is 24

```
           24
           24
           --
           96
          48
          ---
          576 Area Base.
           18
         ----
         4608
         576
        -----
   144)10368
        1008
        ----
         288
         288
         ---
         ...
```

```
Or thus F.   I.
        2    0
        2    0
       ---  ---
        4    0
       18
       ---  ---
       72    0
```

Content the false way, 72 Feet.

The Operation the true way.

```
          96
          96
         ---
         576
        864
        ----
        9216
      107958
      ------
       73728
      46080
     82944
    64512
    ------------
    733.40928 the Area
           18
   ------------
   586727424
  73340928
  ------------
  13201.36704
```

```
44)13201.36704(91.67
   ------
    241
     973
     1096
     ----
       88
```

The true Content 91.67 Feet.

By Scale and Compasses.

Extend the Compasses from 12 to 24 (the fourth Part of the Girt) and that Extent turn'd twice over from 18 Feet (the Length) will at last fall upon 72 Feet, the Content the customary way.

Extend again from 42.54 to

96 (the Girt) and that Extent will reach from 18 Feet (turn'd twice over) to 91.67 Feet the true Content.

Example 2. If a Piece of Timber be 86 Inches Girt, and 20 Feet long, how many Feet does it contain?

The fourth Part of 86 is 21.5

F.	I.	P.	
1	9	6	
1	9	6	
1	9	6	
1	4	1	6
	0	10	9
3	2	6	3
			20
64	2	5	0

```
      21.5
      21.5
     ------
      1075
      215
     430
     ------
     262.25
         20
     --------
144)9245.00(64.2
     605
      290
      ---
       20
```

The Content the false way, 64.2 Feet.

The Operation the true way.

```
      86
      86
     ---
     516
    688
    ----
    7396
   07958
   -----
   59168
  36980
 66564
51772
---------
588.57368
```

```
      588.57368
             20
     -----------
144)11771.47360(81.74
      251
      1074
       667
       ---
        91
```

The true Content is 81.74 Feet.

By

By Scale and Compasses.

Extend the Compasses from 12 to 21.5, and that Extent turn'd twice over from 20, will reach at last to 64.2 Feet, the Content the false way.

Again, extend the Compasses from 42.64 to 86, and that Extent turn'd twice over from 20, will at last fall upon 81.74 Feet, the true Content.

§ 4. *The measuring of Round Timber, whose Bases are unequal.*

The customary way of measuring Round Timber (as has been said before) is to take a fourth Part of the Girt in the middle of the Piece, for the Side of a mean Square.

But this way has been prov'd to be erroneous in Timber that is all the Length of an equal Thickness; and it must of Necessity be much more so in Timber that is tapering; and the greater will the Error be the more tapering the Timber is. For to an Error in the last foregoing Section, there will be added the Error in the preceeding Section; therefore in order to measure all such Timber according to Art and Truth, such a Piece ought to be considered as a *Frustum* of a Cone, and should be measured by Rules given for measuring that; by which Rules the following Examples are wrought.

Example 1. If a Piece of Timber be 9 Inches Diameter at the lesser End; and 36 Inches at the other End, and 24 Feet in Length, how many Feet of Timber does it contain?

```
       36     36 } Subtract.
        9      9 }
      ---    ---
Rect. 324     27 Difference.
              27
             ---
             189
             54
             ---
          3)729 the Square.
             ===
             243 one third.
             324 Rectangle add.
             ---
             576
```

```
         7854
          567
        -----
        54978
       47124
      39270
      -------
      445.3218 a mean Area.
            24
      --------
      17812872
      8906436
      --------
144)10687.7232(74.22
     -----
      607
       317
        292
        ---
          4
```

Answer 74.22 Feet.

Or thus, by Feet and Inches.

F.	I.	
3	0	
0	9	
2	3	Rect.

F.	I.		
2	3		Difference.
2	3		
4	6		
0	6	9	
5	0	9	the Square.
1	8	3	one third.
2	3	0	Rect. added.
3	11	3	a mean Sq.

Then as 14 is to 11, so is 3 : 11 : 3 to the Area.

	F.	I.	P.	
	3	11	3	
			11	
7)	43	3	9	
2)	6	2	3	
	3	1	1	6
				6
	18	6	9	0
				4
	74	3	0	0

Here instead of dividing by 14, I divide by 7 and by 2, because twice 7 is 14.

And instead of multiplying by 24 Feet (the Length) I multiply by 6 and by 4, because 6 times 4 is 24.

By Scale and Compasses, this is too troublesome.

Example 2. If a Piece of Timber be 136 Inches in Circumference at one End, and but 32 Inches Circumference at the other End, and 20 Feet in Length, how many Feet of Timber does that Piece contain?

```
   136              136
    32               32
  -----            -----
   272              104 Difference.
  408               104
  -----            -----
  4352              416
                   104
                  -------
                  3)10816 the Square.
                  -------
                    3605.333  one third.
                    4352      Rectangle add.
                    --------
                    7957.333  a mean Circum. squar'd.
                      .07958
                  ----------
                   63658664
                  39786665
                 71615997
                55701331
                ------------
                633.24456014 the mean Area.
                          21
                ------------
                633.24456014
             12664 8912028
             ---------------
             13298.13576294

           144)13298.13(92.34
               --------
                 338
                 501
                  693
                  ---
                  117
                Answer 92.34 Feet.
```

By Feet and Inches thus.

```
 I.          F.   I.
: 4          8 :  8 Difference.
: 8          8 :  8
---          ------
: 8         69 :  4
: 6 : 8      5 :  9 :  4
-------     ------------
: 2 : 8   3)75 :  1 :  4 the Square.
-------     ------------
            25 :  0 :  5 :  4
            30 :  2 :  8 :  0
            -----------------
            55 :  3 :  1 :  4 the Sq. of the
                             (Circumference.

            F.     I.     P.     S.
: 7 : :     55  :  3  :   1  :   4 the mean Area.
                                 7
         ---------------------------
     11)386  :  9  :  9  :  4
         ---------------------------
      8) 35  :  1  : 11  :  9
         ---------------------------
          4  :  4  :  8  : 11 the mean Area.
                            7
         ---------------------------
         30  :  9  :  2  :  5
                            3
         ---------------------------
   Facit 92  :  3  :  7  :  3
```

The Price of felling and ...ing of Timber.] They have ... and 14*d. per* Load for ...ng of Timber, and about ... *per* Load for hewing.

...ow much Timber goes to a ...are of Framing.] Mr. *Ley...n* tells us that 20 Foot of ...l Timber (cut into conve...t Scantlings) will compleat ...*quare* (*i. e.* 100 Superficial Feet) of any Building great or small, *i. e.* the Carcass, *viz.* outside Frame, Partitions, Roof and Floors.

TONDINO [in *Architecture.*] See *Tore.*

TOP-BEAM. See *Collar-Beam.*

TORE } [in *Architecture*]
TORUS } is a thick, round Moulding, us'd in the Bases of Columns

Columns: It is the bigneſs that diſtinguiſhes the *Torus* from the *Aſtragal*.

TORSEL. See *Taſſels*.

TRACTRIX [in *Geometry*] a curve Line, call'd alſo *Catenaria*.

TRABEATION is the ſame as *Entablement*.

TRAMMEL, an Iron moving Inſtrument in Chimneys, whereon they hang the Pot over the Fire.

TRANSMISSION [in *Opticks*, &c.] The Act of a tranſparent Body, paſſing the Rays of Light through its Subſtance, or ſuffering them to paſs, in which Senſe, the Word ſtands in Oppoſition to Reflection.

TRANSOM [in *Building*] a Piece that is fram'd croſs a double Window-light.

Mr. *Wing* ſays, Tranſom-Windows in great Buildings, are worth *6 s. 9 d.* or *7 s. per* Window.

TRANSMUTATION [in *Geometry*] is the reducing or changing one Body into another of the ſame Solidity, but of a different Figure; as a Triangle into a Square; a Pyramid into a Parallelopiped, &c.

TRANSVERSE, Going acroſs from the right to the left.

TRAPEZIUM, is a Figure having four unequal Sides and oblique Angles. See *Pl. Fig.* 3.

To find the Area or Superficial Content.

The RULE.

Add the two Perpendiculars together, and take half the Sum and multiply that half Sum [by] the Diagonal; or multiply t[he] whole Sum by half the Di[a]gonal, and the Product will [be] the Area, or

You may find the Area's [of] the two Triangles A B C, a[nd] A C D (by the Rules for T[ri]angles) and add thoſe Area's [to]gether, and the Sum will be t[he] Area of the *Trapezium*. S[ee] *Triangle*.

D F =	30.1
D E =	24.5
Sum	54.6
Half	27.3
A C =	80.5
	1365
	2184
Area	2197.65

Let *A B C D* be a *Tr[ape]zium* given, the Diagona[l] which is 80 5, and the [Per]pendicular *B F* 30.1, and [the] Perpendicular *D E* 24.5. T[hese] two being added together, [the] Sum is 54.6. the half of w[hich] is 27.3. which multiply'd [by] the Diagonal 80.5, the Pro[duct] will be 2197.65, which i[s the] Area of the *Trapezium*;

If 40.25 half the Diag[onal] be multiply'd by 54.6 the w[hole] Sum of the Perpendicular[s, the] Product will be 2197.65 [the] ſame as before.

By Scale and Compaſſ[es].

Extend the Compaſſes [from] 2 to 54.6; and that Exten[t]

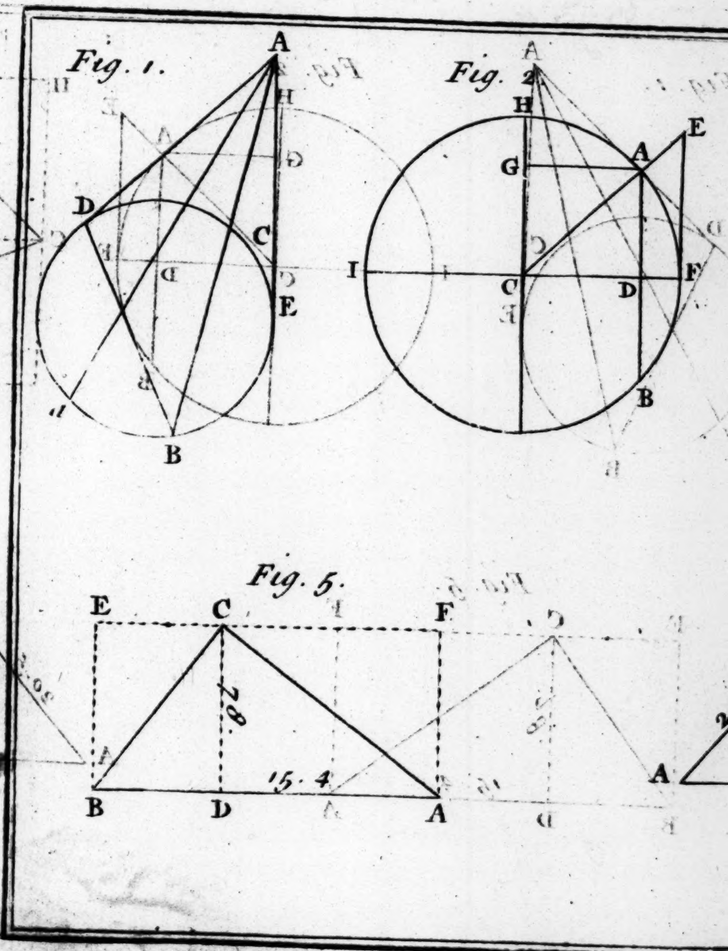


Fig. 1.
A
H
D
C
E
B
d
Fig. 2
A
H
G
E
A
I
C
D
F
B
Fig. 5.
E
C
F
78.
15. 4
B
D
A
A

Plate *

Fig. 3.

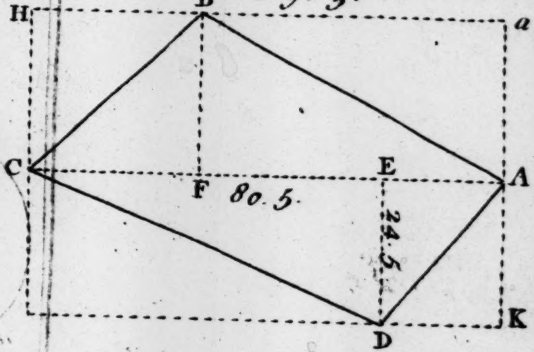


Fig. 4.

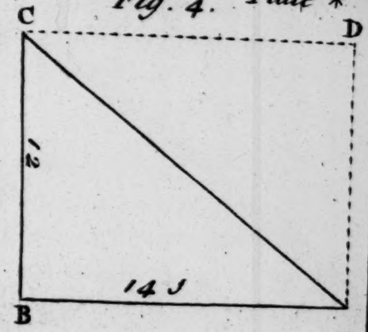


Fig. 6.

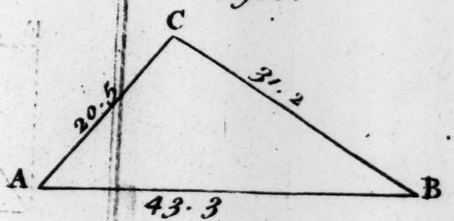
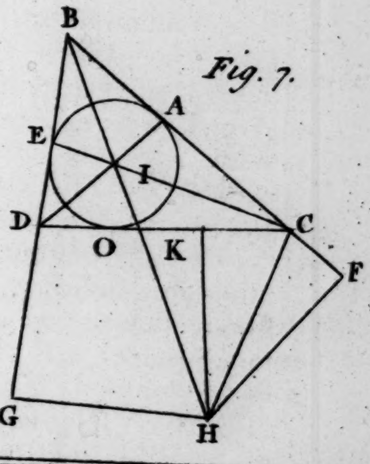


Fig. 7.



*

ach from 80.5 to 2197.65, the rea.

Demonstration.

This Figure *ABCD* is compos'd of two Triangles; the Triangle *ABC* is half the Parallelogram *AGHC*: also the Triangle *ACD* is equal to half the Parallelogram *ACIK* as is prov'd.

Wherefore the *Trapezium* *ABCD*, is equal to half the Parallelogram *GHIK*. See *Triangle*.

To find the Area $HI = BF + DE$; therefore half $HI \times AC$ ($= KI = GH$) $=$ Area of the *Trapezium*: which was to be prov'd.

To TRAVERSE [in *Joinery*] signifies to plane a Board or the like, a-cross the Grain.

TRAVERSE *Tile*. See *Tile*.

TRELLIS, an Assemblage or setting together of wooden or Iron Bars, which cross one another in a strait Line or sloping-wise, the Use of it being for Wall-Fruit Trees. You must first cramp some Hooks, check-wise into the Wall, three Foot distant from one another, leaving two Inches jutting out, to lay the Poles or Props upon: Oak being the most lasting, is most in request, provided there be no Sap in it; having gotten together a sufficient Quantity of Props, the Carpenter must make them smooth and strait, without weakening them; and place them on Hooks, one over another; the Square ought to be seven Inches wide and eight high; an oblong Square will be more graceful than one that is perfect; you may fasten them together with Wire, and when the *Trellis* is finish'd, if the Props are painted in some Oil Colour, it will make them last the longer.

There is another Sort of *Trellis* made of Iron Wire; for which suppose the Wall where you are to make it be nine Foot, your Bearers must be of an equal Height, fix'd in three Rows, two Foot distant one from another, and must place your Poles upon every Row, each nine Foot long, join'd together at the Ends, and fastened to the Bearers of every Row with an Iron Wire.

These Poles are to be continued the Height of the Wall, from six Fathom to six Fathom, tied to one of the Bearers of every Row; the Poles are put upon the Bearers, because the Wire *Trellis* may be well tyed and fastened.

The Squares are to be made after the Manner of those of Wood; that is, seven Inches long, and eight high; your Expence this way, will be two thirds less than the other, and the Work will last infinitely longer.

If instead of Props, you made Use of Iron Rods, such as Glaziers use in their Casements, they would continue a long time serviceable.

TRIANGLE [in *Geometry*] is a Figure comprehended under three Lines, and which consequently has three Angles.

If the three Lines or Sides of the *Triangle* be right, it it

 said

ſaid to be a *plane* or *rectilinear Triangle.*

If all the three Sides of the *Triangle* be equal, it is call'd an *equilateral Triangle.*

If only two Sides of the *Triangle* be equal to one another, it is call'd an *Iſoſceles* or *Equicrural Triangle.*

If all the Sides of the *Triangle* be *nuequal*, it is call'd a *ſcalenous Triangle.*

If one of the *Angles* of a *Triangle*, be a Right Angle, the *Triangle* is ſaid to be *rectangular.*

If one of the Angles of a *Triangle* be obtuſe, the Triangle is ſaid to be *obtuſe angular*, or *amblygonous.*

If all the Angles be acute, the *Triangle* is ſaid to be *acute angular*, or *oxygonous.*

If the three Lines of the *Triangles* be all Curves, the *Triangle* is ſaid to be *curvilinear.*

If ſome of the Sides of a *Triangle* be right, and others curve, it is ſaid to be *mixti near.*

TRIANGLE is a Figu having three Sides and thr Angles.

To find the Superficial Conte of a Triangle.

The RULE.

Let the *Triangle* be of wh Kind ſoever, multiply the B by half the Perpendicular, half the Baſe by the whole P pendicular; or multiply whole Baſe by the whole P pendicular, and take half Product, any of theſe th ways will give the Content.

Let *ABC* be a right ang *Triangle*, whoſe Baſe is 1 Feet, and the Perpendicu 12 Feet; multiply 14.1 by half the Perpendicular, and Product will be 84.6 Feet, Content: or,

Multiply 14.1 by 12, Product will be 169.2, the h of which is 84.6, the ſame before. *Fig.* 4.

14.1 Baſe
6 half Perpendicular

84.6 Product

14.1 Baſe
12 Perpendicular

169.2 Product

84.6 half

By Scale and Compaſſes.

Extend the Compaſſes from 2 to 14.1, that Extent reach the ſame way from 12 84.6 Feet, the Content.

15.4 Baſe.
3.9 half Perpendicular.

1386
462

60.06 Product.

15.4 Base
7.8 Perpendicular

1232
1078

120.12

60.06

7.7 half Base.
7.8 Perpendicular

616
539

60.06

Let *A B C* (Figure 5) be an oblique-angled Triangle given, whose Base is 15.4, and the Perpendicular 7.8. If 15.4 be multiply'd by 3.9 (half the Perpendicular) the Product will be 60.06 for the Area or Superficial Content: Or if the Perpendicular 7.8 be multiply'd into half the Base, 7.7, the Product will be 60.06 as before: Or if the whole Perpendicular 7.8, the Product will be 120.12 which is the double Area; the half of which is 60.06 Feet, as before.

By Scale and Compasses.

Extend the Compasses from 1 to 15.4, that Extent will reach from 7.8 to 60.06 Feet, the Content.

Demonstration.

If *AD* (Fig. 4.) be drawn parallel to *B C*, and *D C* parallel to *AB*; the Triangle *ABC* shall be equal to the given Triangle *A D C*. Hence the Parallelogram *ABCD* is double to the Triangle given; therefore half the Area of the Parallelogram is the Area of the Triangle.

In Figure 5. the Parallelogram *A B E F*, is also double to the Triangle *A B C*, for the Triangle *A C F* is equal to the Triangle *A C D*, and the Triangle *B C E* is equal to the Triangle *B C D*; therefore the Area of the Parallelogram is double to the Area of the given Triangle, which was to be prov'd.

To find the Area of any Plain Triangle, by having the three Sides given, without the Help of a Perpendicular.

The RULE.

Add the three Sides together, and take half that Sum; then subtract each Side severally from that half Sum. This being done, multiply that half Sum and the three Differences continually, and out of the last Product extract the *Square* Root, which Square Root shall be the Area of the Triangle sought.

Example. Let *A B C Fig.* 6. be a Triangle, whose three Sides are as follows, *viz.* *AB*, 43.3. *AC.* 20.5 and *B C* 31.2, the Area is required.

	Sides	Differences
	43.3	4.2
	31.2	16.3
	20.5	27.0
Sum	95.0	

Area 296.31.

```
          47.5  half Sum.
            27  Difference.
        ------
         3325
         950
        ------
        1282.5  Product.
          16 3  Difference.
        ------
         38475
        76950
       12825
      --------
      20904.75  Product.
           4.2  Difference.
      --------
      4180950
     8361900
     --------
     8799.9500
                 . . . . .
                87799.9500 (296.31
                4
               ---
             49)477
                441
               -----
            586)3699
                3516
               -----
          5923)18395
               17769
               ------
         59261)62600
               59261
               -----
                3339  Remains.
```

Dem

Demonstration.

In the Triangle BCD, *Fig.* 7. if from the half Sum of the Sides you subtract each particular Side, and multiply the half Sum and the three Differences together, the square Root of the Product shall be the Area of the Triangle.

First, By the Lines B I, C I, and D I, bissect the three Angles, which Lines will all meet in the Point I; by which Lines the given Triangle is divided into three new Angles C B I, D C I, and B D I; the Perpendiculars of which new Triangles, are the Lines A I, E I and O I, being all equal to one another; because the Point I is the Centre of the inscrib'd Circle, (by *Euclid. Lib. IV. Prop.* 4.) wherefore to the Side B C, join C F equal to D E or D O; so shall B F be equal to half the Sum of the Sides *viz.* $= \frac{1}{2}$ B C $+ \frac{1}{2}$ B D $+ \frac{1}{2}$ C D.

And B A = B F — C D, for C A = C O and O D = C F therefore C D = A F and A C = B F — B D for B E = B A and E D = C F: Therefore B D = B A + C F and C F = B F — B C.

Then make C K = C F and draw the Perpendiculars F H, G H, and K H, and extend B I to H; because the Angles F C K more F H K are equal to two Right Angles (for the Angles F and K are Right Angles) equal also to F C K + A C O (by *Euclid* I. 13.)

And the Angles A C O + A I O are equal to two Right Angles; therefore the Quadrangles F C K H, and A I O C are alike; and the Triangles C F H, and A I C are also similar; and the Triangles B A I, and B F H are also similar.

From this Explanation it appears that the Square of the Area of the given Triangle will be B F q x I A q = B F x B A x C A x C F. In Words

The Square of B F (the half Sum of the Sides) multiply'd into the Square of I A (= I F = I O) will be equal to the said half Sum multiply'd into all the three Differences.

For I A : B A : : F H : B F, and I A : C F : : A C : F H; because the Triangles are similar. By *Euclid, Lib. VI. Prop.* 4.

Wherefore multiplying the Extreams and Means in both, it will be I A q x B F x F H = B A x C A x C F x F H; but F H being on both Sides of the Equation, it may be rejected; and then multiply each Part by B F q x I A q = B F x B A x C A x C F: which was to be demonstrated. See the *Plate.*

TRIANGULAR *Compasses* are such as have three Legs or Feet, whereby to take off any Triangle at once.

TRIANGULAR *Numbers* are a kind of Polygonous Numbers; being the Sums of Arithmetical Progressions, the Difference of whole Terms is 1: thus

1	2	3	4	5	6
1	3	6	10	15	21

TRIDENT [with *Mathematicians*] is us'd for a kind of Parabola, by which *Cartes* constructed Equations of six Dimensions.

TRIGLYPHS [in *Architecture*] a Sort of Ornament repeated at equal Intervals in the *Doric* Freeze; or they are a kind of Steps (in the *Doric* Freeze) between the Metopes.

TRIGLYPHS. The ordinary Proportion of them is one Module in Breadth, and one and a half in Height. But in Regard these Measures occasion a Disproportion in the Intercolumniations of Portico's (a thing particularly observable in *Vignola*, who makes the Pillars there five Modules broad.) M. *Le Clerc* accommodates the Proportion of his, *i. e.* the Triglyphs, to that of the Intercolumniations; thinking it more reasonable to make the little Parts correspond to the greater, than the greater to the less; and yet is of Opinion, that his Triglyphs, tho' different from the ordinary ones, are not inferior to them in Beauty.

When the *Triglyphs* and *Metopes* follow each other regularly, the Columns must only stand one by one; excepting those of the inner Angles, which ought always to be accompanied with two others, one on each Side; from which the rest of the Columns may be plac'd at equal Distances from each other; and it is to be observ'd, that these two Columns, which accompany that of the Angle, are not less necessary, on Account of the Solidity of the Building, than of the regularity of the Intercolumniations.

TRIGON [in *Geometry*] a Triangle.

TRIGONOMETRY, is the Art of finding the Dimensions of the Parts of the Triangle unknown, from other Parts known: Or it is the Art whereby from any 3 Parts of a Triangle given, to find the three other Parts.

Plain TRIGONOMETRY, is the Art whereby, from any three given Parts of a plain Triangle, we find all the rest.

Thus, e. g. *from two Sides* A B *and* A C, *and an Angle* B, *we find by* TRIGONOMETRY, *the other Angles* B *and* C, *with the third Side* B C. *Plate*, *Fig.* 1.

A *Chord* of an Arch or Angle, is a right Line A B, dividing the whole Circle into two Parts, and subtends both Segments. *Fig.* 2.

Hence, the greatest Chord that can be drawn in a Circle, is the Diameter.

Hence also, all the Chords of Arches, greater than a Semicircle, are less than the Diameter.

A *right Sine* A D, of the Arch A E or A I, is one half of the Chord A B of the double Arch A E B or A I B.

Hence, the Sine A D *is perpendicular to the Radius* E C, *consequently, all Sines standing upon the same Radius, are parallel between themselves.*

A *whole Sine*, is the Radius H C, or the Sine of the Quadrant H E.

A *versed Sine*, is that Part of the Radius E D, or D I, intercepted betwixt the right Sine A D, and the Arch A E or A I.

Hence, the greatest versed Sine, is the Diameter E I.

Since

Since that the Arch A E *is the Measure of the Angle* ACE, *and* A I *is the Measure of its contiguous Angle* A C I; *but the Quadrant* H E *is the Measure of a Right Angle*; A D *will also be the right Sine, and* E D *the versed Sine of the Angles* ACE *and* ACI; *but the whole Sine is the Sine of a right Angle.*

Therefore two Angles, which are adjacent, have the same Sine. Likewise obtuse Angles have the same Sines, which their Complements have to two right ones.

A *Tangent* of an Arch A E is a right Line, E F touching the Circumference of the Circle, and is at right Angles to the Diameter E I, and limited by F C, called the Secant of the same Arch.

F E *is also the Tangent, and* F C *the Secant of the Angle* A C E, *and also of the Angle* A C I.

Therefore two adjacent Angles have the same Tangent and Secant.

The *Cosine*, is the Sine A G, the *Cotangent* F H is the Tangent, and the *Cosecant* F C is the Secant of the Arch A H, which is the Complement of the other Arch A E to a Quadrant.

The Complement of an Arch or Angle, is what it wants of a Quadrant, a Semicircle, or of a whole Circle. Thus 20 *Degrees is the Complement of* 70 *Degrees to a Quadrant; because* 20 *Degrees is the Remainder of* 70 *Degrees subtracted from* 90 *Degrees: Also,* 50 *Degrees is the Complement of* 130 *to* 180 *Degrees, and* 70 *the Complement if* 290 *to* 360 *Degrees.*

The Radius C A, with the Sine A D and Cosine D C, make a Triangle C A D, similar to the Triangle C F E made by the Radius C E, Tangent E F, and Secant C F. Likewise the Radius, Cotangent and Cosecant, make another Triangle, similar to the two former.

Hence as the Cosine is to the Sine, so is the Radius to the Tangent. That is, as C D : A : : C A : E F.

As the Radius is to the Sine, so is the Secant to the Tangent. That is, as C A : A D : : C F : F E.

As the Sine is to the Radius, so is the Radius to the Cosecant. That is, as D A : C A : : H C : C F.

As the Tangent is to the Radius, so is the Radius to the Cotangent. That is, as F E : E C : : C H : F H.

Therefore the Rectangle, between the Tangent and Cotangent of any Arch, is equal to the Square of the Radius.

When a Triangle is given to be resolv'd, first, we are to consider, that there is in the Table of *Logarithms*, Sines, Tangents, and Secants, a Triangle exactly similar and equal to that which is to be solved, and whose Sides are to one another in the same Proportion of those of the Triangles proposed.

Next, we must understand whatever *Ratio* one Side of the given Triangle has to the other Side about the same Angle, consi-

considered as Lengths, estimated or numbred by any known Measure: As suppose, Inches, Yards, Miles, &c. the very same has the two Sides about the same Angle, in the Triangles in the Tables, or in the tabular Parts; which two things, well understood, will lead us into the whole Mystery of Trigonometrical Calculations.

In estimating the Quantity of Sines, &c. *we assume Radius for Unity; and determine the Quantity of Sines, Tangents and Secants in Fractions thereof. From* Ptolomy's Almagest, *we learn, that the Ancients divided the Radius into* 60 *Parts, which they called Degrees; and thence determined the Chords in Minutes, Seconds and Thirds; that is, in sexagesimal Fractions of the Radius, which they likewise used in resolving Triangles. The Sines or half Chords, were first used by the* Saracens. Regiomontanus, *first, with the Ancients, divided the Radius into sixty Degrees, and determined the Sines of several Degrees in decimal Fractions thereof. But he afterwards found it would be more commodious to assume Radius for one; and thus introduced the present Method into* Trigonometry. *In common Tables of Sines and Tangents, the Radius is supposed to be divided into* 10,000,000 *Parts, beyond which we never go in determining the Quantity of Sines and Tangents. Hence, as the Sine of a Hexagon subtends the sixth Part of a Circle, and is equal to the Radius, the Sine of* 30 *Degrees, is* 5,000,000.

TRIGONOMETRICAL PROBLEMS.

PROB. I.

The Sine A D *being given, to find the Cosine, or Sine Complement,* A G. See *Pl. Fig.* 2.

Because that E C, the Sine of the same Arch E H, is perpendicular to H C and A G; the Sine of the Arch A H is perpendicular to the same HC; A G will be parallel to D C, and the Angle A G C a right Angle, and so A G C will be a right angled Triangle. Wherefore, seeing A D and H C are perpendicular to E C; G C will be equal to A D. If therefore from the Square of the Radius A C be subtracted the Square of the Sine A D, or G C, the Remainder will be the Square of the Cosine A G. Whence if the square Root be extracted, it will give the Cosine A G. *e. g.* Let A C be 10,000,000, A D 5,000,000, A G will be 8,660,254, the Sine of 60 Degrees.

PROB. II.

The Sine A D *of the Arch* A E *being given, to find the Sine of half that Arch. Fig.* 2.

Find the Chord of the Arch A E; for half of this is its Sine. Thus, *e. g.* D G and A D, as in the preceeding Problem, we shall find the Sine of half the Arch A E, or the Sine of 15 Degrees = 2,588,190.

PROB. III.

The Sine D G *of the Arch* D F

DF *being given, to find the Sine* DE *of the double Arch* DB. *Fig*. 3.

Since the Angles at E and G are right Angles, and the Angle B is common to both Triangles, BCG and DEB; BC : CG :: BD : DE. Wherefore CG being found by the second Problem, and BD being double of DG; DE is found by the Rule of Proportion.

Hence, CB : 2CG :: BD : 2DE, *that is, the Radius is double to the Cosine of one half of the Arch* DB, *as the Subtense of the Arch* DB *is to the Subtense of double the Arch. Also, as* CB : 2CG :: ½ 2BG : 2DE :: ½ BG : DE :: ½ CB : CG. *Wherefore, the Sine of any Arch, and the Sine of its Double being given, the Cosine of the Arch it self is given.*

PROB. IV.

The Sines FG *and* DE *of the Arches* FA *and* DA, *whose Difference* DF *is not greater than* 45 *Minutes, being given, to find any intermediate Sine, as* IL. *Fig*. 4.

To the Difference FD of the Arches, whose Sines are given; the Difference of the Arch IF, whose Sine is required, and the Difference of the given Sines DH, find a fourth Proportional: This added to the less given Sine FG, the Aggregate will be the Sine required.

PROB. V.

The Sines BD *and* EF *of the two Arches* AB *and* AF, *being given, to find the Sine* BF *of the Arch of half the Difference.*

Subtract the lesser Sine BD from the greater EF, and the Remainder will be FK. From the given Sines BD and EF, find the Cosines BI and FH, by Problem I, subtract the lesser Cosine FH from the greater BI, the Difference will be BK. Extract the square Root from the Sum of the Difference of the Squares, the Remainder will be BF, the half of which is the Sine sought.

PROB. VI.

To find the Sine of 45 *Degrees. Fig*. 2.

Let HI be a Quadrant of the Circle, then will HCI be a Right Angle; consequently the Triangle, rectangular: Therefore $HI^2 = HC^2 + CI^2 = HC^2$; wherefore, since HC the whole Sine, is 10,000,000; if from 2 HC^2 squared 200,000.000,000,000 be extracted, the square Root 14,142,136, the Chord HI will be the Remainder, whose half 7,071,068, the Sine of 45 Degrees required.

THEOREM VII.

In small Arches, the Sines and Tangents of the same Arches are nearly to one another, in a Ratio of Equality. Fig. 5.

The Triangles CED and CBG being equiangular, CE : CB :: ED : BG; but as the Point E approaches B, EB will vanish in respect of the Arch BD.

BD. Whence CE will become nearly equal to C B. and so ED will also be nearly equal to BG. If EB be less than the $\frac{1}{10\,000\,000}$ of the Radius, then the Difference between the Sine and the Tangent will also be less than the $\frac{1}{10\,000\,000}$ Part of the Tangent.

Since any Arch is less than the Tangent, and greater than its Sine, and the Sine and Tangent of a very small Arch, are nearly equal, it follows, that the Arch will be nearly equal to its Sine; and so in very small Arches it will be, as Arch is to Arch, so is Sine to Sine.

PROB. VIII.

The Sine of one Minute or 60″ F G being given, to find the Sine of one or more Seconds M N. Fig. 4.

Since the Arches A M and A F are very small, A M F may be taken for a right Line, without any sensible Error in the Decimal Fractions of the Radius, wherein the Sine is expressed; that is, the Arches A M and A F, may be taken proportional to their Chords. Wherefore, since M N is parallel to FG: AF : FG :: AM : MN. Therefore A F, F G and A M being given, M N is easily had.

PROB. IX.

To find the Sine of the Arch of one Minute.

The Subtense of 60 Degrees is equal to the Radius, so the half of the Radius will be the Sine of the Arch of 30 Degrees. Wherefore, the Sine of the Arch of 30 Degrees being given, the Sine of the Arch of 15 Degrees may be found, (by Prob. II.) and so on till twelve Bisections being made, we come to an Arch of 52^{2}, 44^{3}, 03^{4}, 45^{5}, whose Cosine is near equal to the Radius, in which Case the Arches are proportional to their Sines: And so, as the Arch 52^{2}, 43^{3}, 03^{4}, 45^{5}, is to an Arch of one Minute, so shall the Sine before found, be to the Sine of one Minute; and when the Sine of one Minute is found, then the Sine and Cosine of two Minutes will be had.

PROB. X.

The Sine A D *of the Arch* A E *being given, to find the Tangent* E F, *and the Secant* F C *of the same Arch. Fig.* 2.

Because the Sine A D, and Tangent E F are perpendicular to the Radius E C, A D will be parallel to E F: Wherefore as the Cosine D C is to the Sine A D, so is the whole Sine to the Tangent E F: Also, as the Cosine D C is to the whole Sine A C, so is the whole Sine E C to the Secant C F.

PROB. XI.

To construct a Canon of Sines.

The Sines of 30°, 15°, 45 and 36°, (which we have already shewn how to find) being had, we can thence construct a Canon of all the Sines to every Minute, or even a Second. For from the Sine of 36°, we find those of 18°, 9°, 4° 30 and 2° 1

(by

(by Prob. II.) the Sines of 54°, 72°, 81°, 85° 30 and 87°45, &c. (by Prob. I.) Again, for the Sine of 45° find the Sine 22°30, 11°15, &c. From the Sines of 30° and the Sines of 54° find the Sine of 12°. From the Sine of 12°, find the Sines of 6°, 3°, 1°30, 4578°, &c. From the Sine of 15° find the Sine of 7°30 30°45, &c. till you have 120 Sines, succeeding each other orderly at an Interval of 45 Minutes. Between these find the intermediate Sines (by Prob. V.) Thus will the Canon be compleat.

PROB. XII.

To find the Logarithms of any given Number.

The first Page of the annexed *Tables of Logarithms* contains all the natural Numbers in their proper Order, from 1 to 100. And against every one of these Numbers, is plac'd its *Logarithm*, with its *Index* before it.--Thus against the Number 28, its Log. is 1.447158; and against the Number 89, its Log. is 1.949390: and so on for the rest. In the first Column of all the following Pages, under *Num.* the natural Numbers proceed in their due Order, from 100 to 1000. And in the next Column, under 0, against every one of these Numbers, is the decimal Part of its Logarithm, without any Index; to which its proper Index must be prefixed, according as the natural Number used requires, *e. g.* against the Number 856, under 0, is 932474; to which if 2 the Index of 856 be prefixed, it will be 2.932474, the compleat Logarithm of 856.

The other five Columns of each Page, contain the Logarithms of all Numbers, from 1000 to 10000. Those in the Left-hand Pages are distinguished on the Top of the Columns with the Figures 0.1.2.3.4, and those in the Right-hand Pages with 5.6.7.8.9. So that to find the Logarithm of any Number between 1,000 and 10,000, as suppose of 5.468 seek for the three first Figures, *viz.* 546, in the first Column under *Num.* and for the last Figure, *viz.* 8, at the Top. Then in the Column under the last Figure 8, and over against the three first Figures 546, there is 737829; to which if 3, the Index of 5.468, be prefixed, the compleat Logarithm thereof will be 3.737829; and so for any other Logarithm of any proposed Number, not exceeding 10,000. But if the proposed Number be above 10,000, *which is the Limits of the annexed Table*, then the Logarithm of that Number must be found, by the Help of the *common Difference* of the Logarithms, which is the last Column of every Page under *Diff.* Thus:

Find the Logarithms of the first four Figures of the given Number, without its Index, as above; and multiply the common Difference which stands against the Logarithm, under Diff. *with the other Figures of the given Number, casting off so many Figures of that Product*

as there are in the Multiplicator; then add the remaining Figures of that Product to the Logarithm of the first four Figures, and to their Sum prefix the proper Index; and you will have the compleat Logarithm required.

Suppose it were required to find the Logarithm of 698,476. First, the Logarithm of 6,984 is found in the Table, as above, to be 844,104 and against it, under *Diff.* is 62. This 62 being multiplied with 76, the other two Figures of the given Number, produces 4.712. Cut off 12, *viz.* the two last Figures, and then add 47 to the Logarithm last found, and the Sum will be 844,151; to which prefixing 5, the proper Index of the given Number 698,476, it will be 5.844,151, the Logarithm required.

PROB. XIII.

To find the Number to any given Logarithm.

Omit the Index of the given Logarithm, and then seek it in the Table of Logarithms, and if exactly found there, then the Number in the first Column under *Num.* with that on the Top, over Logarithm, will be the Number required. But if the given Logarithm without its Index, cannot be exactly found in the Table, then the proper Number agreeing to that Logarithm may be found by the Help of the common Difference of Logarithms: Thus:

From the given Logarithm subtract the next less, and to the Remainder annex Cyphers; then divide it by the common Difference found against the next Logarithm, under Diff. *and the Quotient will be a Number that must be annex'd to the Number already found against the next less Logarithm, according as the Index of the given Logarithm denotes.*

Suppose, 5.660279 were a given Logarithm, and it were required to find the natural Number answering it.

The Number sought, must consist of six Places of Figures in whole Numbers, as appears by its Index 5; which being omitted, seek in the Table of Logarithms for 660279; but not finding it exactly there, take the next less to it, *viz.* 660201 standing under 3. and against 547: Therefore the first four Figures of the Number sought must be 4,573, and the common Difference found against 660201, under *Diff.* is 95.

Then for the Logarithm	660279
Subt. the next less, *viz.*	660201
Remains	78

To which annex two Cyphers, because there is yet wanting two Places of Figures, and it will be 7,800, which being divided by the common Difference 95, the Quotient will be 82, which must be annexed to 4.573, and the Sum will be 457, 382, the Number answering to the given Logarithm 5.660279. Thus the Logarithm of any given Number may

may be easily found, altho' it exceeds the Limits of the Table by 1,203 Places of Figures, and also the Number agreeing to any given Logarithm, without the Help of such a Table of proportional Parts, as is usually inserted along with the Table of Logarithms for that Purpose.

PROB. XIV.

Having given a short Description of Sines, Tangents, &c. we shall here shew the Geometrical Construction of those and other Scales commonly used in projecting the Sphere in Plano and in Trigonometry, Navigation, Dialling, and other Parts of practical Mathematicks, as they are deduced from a Circle. *Fig. 6.*

Upon a Sheet of fine Pasteboard, or such like Matter, describe a Circle ABDC with any Radius, which cross at right Angles with the Diameters AB and CD; then continue AD to G, and upon the Point B raise BF perpendicular to CB. Draw the Chord AB, and divide the Quadrant AB into nine equal Parts, setting the Figures 10, 20, 30, &c. to 90; each of which nine Parts again subdivide into 10 equal Parts, and then the Quadrant will be divided into 90 Degrees. Set one Foot of the Compasses in the Point A, transfer the said Divisions to the Chord Line AB, and set thereto the Figures 10, 20, 30, &c. and the Line of Chords AB will be divided.

To project the *Sines*, divide the Arch BD into 90 Degrees; from each of which Degrees, let fall Perpendiculars on the Semi Diameter EB, which Perpendiculars will divide EB into a Line of Sines, to which set the Numbers 10, 20, &c.

To project the *Line of Tangents*, from the Centre E, and thro' every Division of the Arch BD, draw the right Lines cutting BF, which will divide it into a Line of Tangents, set thereto the Numbers 10, 20, &c.

To project the *Line of Secants*, transfer the Distances E 10, E 20, &c. from the Tangent Line, upon the Line EG, and set thereto the Numbers 10, 20, &c. The Line EG will be divided into Line of Secants.

To project the *Semi-tangents*, draw Lines from the Point C thro' every Degree of a Quadrant AB, and they will divide the Semi-diameter AE into a Line of Semi-tangents; but because the Semi-tangents on Scales run to 160 Degrees, continue the Line AE, and draw Lines from the Point C thro' the Degrees of the Quadrant CA, cutting AE, and you will have the Line of Semi-tangents to 160 Degrees, &c.

To project the *Rhumb line*, from every eighth Part of the Quadrant AC, set one Foot of the Compasses in A, describe an Arch cutting the Chord AC, which will divide AC into a Line of whole Rhumbs.

To project the *Line of Longitude*, draw HD equal and parallel to the Radius CE, which divide

divide into 60 equal Parts, every 10 of which, number. Now from every one of these Parts let fall Perpendiculars to CE, cutting the Arch CD; and having drawn the Chord CD, with one Foot of the Compasses in D, transfer the Distances from D to each of the Points in the Arch CD on the Chord CD, and set thereto the Numbers 10, 20, &c. and the Line of Longitude will be divided.

These are all the Lines commonly put upon one Side of the Plain Scale, except equal Parts, which want no Description: And on the other Side is a Decimal or Diagonal Scale, on which an Inch, or some Part thereof, as $\frac{1}{2}$ or $\frac{1}{4}$ is divided into 100 equal Parts, by Diagonals.

Of the Uses of the Chords, Sines and Tangents, &c. *upon the Rule.*

The Chords are to lay off the Quantity of an Angle desired upon a given Point in a right Line, and to measure the Quantity of an Angle already laid down. The first is done, by taking the Extent of 60 Degrees of Chords between the Compasses, and describing an Arch about the angular Point; then laying off the Number of Degrees proposed, upon the said Arch, and drawing a right Line from the angular Point. And the latter, by making an Arch of 60 Degrees of Chords about the angular Points, and then taking the Chord of the said Arch, between the Compasses, and measuring it on the Line of Chords.

Example. To make an Angle of 30 Degrees on the Point A, Take 60 Degrees of Chords in the Compasses, and setting one Foot in A, describe the Arch DC; then take off 30 Degrees from the Chords, lay them off from D to C, and draw the Line AC. The Angle CAB will be 30 Degrees, *Fig.* 7.

To measure an Angle, suppose CAB. Take 60 Degrees of Chords, between the Compasses, and casting one Foot in A, describe the Arch CD; then take the Distance from C to D; which, measured on the Chords, will reach to 30 Degrees, the Quantity of the Angle sought.

The Sines are to project the Sphere orthographically, &c.

The Tangents, Half-Tangents and Secants, are used in finding the Centers and Poles of projected Circles in the Stereographical Projection of the Sphere, &c.

The Rhumbs, are to lay down the Angles of a Ship's Way in Navigation.

And the Line of Longitude determines, by Inspection, how many Miles there are in a Degree of Longitude, in each several Latitude, as in the Latitude of no Degrees, that is under the Equator, 60 Miles make a Degree; in the Latitude of 40 Degrees, 46 Miles make a Degree, in the Latitude of 60 Degrees, 30 Miles make a Degree; in the Latitude of 80 Degrees, 10 Miles make a Degree.

Having thus laid the Foundation, we shall next shew the Resolution of all right lined Tri-

Triangles in as plain and familiar Method as possible.

Of resolving TRIANGLES.

THEOREM I.

In any right-angled Triangle if either of the Legs be made Radius, the other Leg will be the Tangent of its opposite Angle, *e.g.* If AD be made Radius, BD will be Tangent of the Arch d D = BAD; and if BD be made Radius, AD will be Tangent of the Angle B. But if the Hypothenuse AB be made Radius, the Legs BD and DA will be the Sines of their opposite Angles A and B. *Fig.* 8.

THEOREM II.

The Sides of every right-lined Triangle are in proportion to one another, as the Sines of their opposite Angles.

In the Triangle ABC make AF = BC, and let fall the Perpendiculars from F and B to the Side AC, describe the Arches HB and FI. Then B D will be the Sine of the Angle at C, and FE the Sine of the Angle at A, and the Triangles A B D and AFE are similar. Therefore, AF : AB : : FE : BD, or as AB : BD : : A F : F E, and A F being equal to B C, and the two Perpendiculars being Sines, it will be, as the Side BC : Side A : : Sine of the Angle A : Sine of the Angle C; as the Side A : Sine of the Angle : : Side B C : Sine of the Angle A. *Fig.* 9.

THEOREM III.

As the Sum of the Legs about an Angle, is to their Difference; so is the Tangent of half the Sum of the opposite Angles, to the Tangent of half their Difference.

Produce, in the Triangle C F D, the Side F D, and make B F = C F; then B D will be the Sum of the Legs, and G D half the Sum; if you take from which the Leg FD, the Remainder G F = ½ the Difference of the Legs; draw CB and bisect it in A, and draw A F, which will be perpendicular to it, and the Angle C A F = the Angle B F A, (by Prop. 8. *Euclid.* l. 1.) but the Angle C F B = the Angle F C D + the Angle D: (by Prop. 32. *Euclid. l.* 1.) Therefore the An- Angle C F A = ½ the Sum of the Angles F C D + D; draw A G, which will be parallel to C D, because the Sides C B and B D are bisected in A and G; then draw E F parallel to CD, which will be parallel to A G; the Angle C F E = the alternate Angle F C D, the lesser Angle of the Triangle, because the Angle C F E = the Angles C + D and E F B = the Angle D, take from both the Angle D, then C F E = the Angle C, which taken from the Angle C F A = ½ the Sum of the opposite Angles, leaves E F A = ½ the Difference of the opposite Angles. Now make AF Radius of a Circle, then E A is the Tangent of half the Difference, and A C the Tangent of half the Sum of the opposite Angles: and the Triangles B A G, B E F and B C D are similar, (by Prop. 2. *Euclid.* l. 6.) and consequently the Sides are proportional. Therefore,

BG : GD :: BA : AC
BG : GF :: BA : AE

Therefore, as GD, half the Sum of the Sides, is to GF Half their Difference; so is AC, the Tangent of half the Sum of the opposite Angles, to AE the Tangent of half their Difference.

But the Wholes are as their Halves: Therefore the Sum of the Sides is to their Difference, as the Tangent of half the Sum of the opposite Angles, is to the Tangent of half their Difference. *Fig.* 10.

THEOREM IV.

In any Triangle whatsoever, as ACB, *the Square of the Side* AB *opposite to an acute Angle* C, *is exceeded by the Squares of the other Sides,* AC *and* CB *by the Rectangle* BCF *twice taken; which Rectangle is contained under* BC, *one of the Sides comprehending the acute Angle* C *and the Line* FC, *intercepted between the Perpendiculars* AF, *let fall upon the Side* BC *from its opposite Angle* A, *and the acute Angle* C.

The Square of $BC = 2$ Rectangles BFC and $FC + FB^2$. And $AC^2 = CF^2 + FA^2$ (by Prop. 47. *Euclid.* l. 1.) Wherefore, $BC^2 + AC^2 = 2\,BFC^2 + BF^2 + 2\,FC^2 + AF^2$. But $2\,BFC + 2\,FC^2 = 2\,BCF$. Therefore this being substituted for them; $BC^2 + AC^2 = 2\,BCF + BF^2 + AF^2$. But $AF^2 + BF^2 = AB^2$ (by Prop. 47. *Euclid, l.* 1.) Therefore this being substituted for them, $BC^2 + AC^2 = 2\,BCF + AB^2$ That is, $BC^2 + AC^2$ excee[ds] AB^2 by $2\,BCF$. *Fig.* 11.

The Theorem is true, altho[ugh] the Perpendicular fall withou[t] the Triangle. And the Demon-stration is almost the sam[e]. For $AC^2 = BA^2 + CB^2 + 2\,CB[F]$ Add on both Sides, CB^2, the[n] $AC^2 + CB^2 = AB^2 + CB^2 + 2\,CBF = AB^2 + 2\,BCF$. *Fig.* 1[2].

From this Theorem, and t[he] 47*th Prop.* Euclid. l. 1. *w[e] have the Measure of any Tr[i]angle whatsoever, whose thr[ee] Sides are known, altho' the Ar[ea] be altogether inaccessible. F[or] by the Help of these Theore[ms] the Perpendicular is known, a[l]tho' the Impediments of t[he] Place should not allow us [to] mark it out. But note, Th[at] the Perpendicular, multipli[ed] by half the Side on which [it] falls, produces the Area of t[he] Triangle.*

Let there be any Triangle, ABC, *having its Sides know[n]. It is required, to find the Pe[r]pendicular* AF *falling from t[he] Angle* A *upon the opposite Si[de]* BC. *Take the Square of t[he] Side* AB, *opposite to the acu[te] Angle* C, *out of the Sum of t[he] Squares* AC *and* BC: *By t[he] last Theorem, the Remaind[er] shall be the Rectangle* BC[F] *twice taken. Divide half the Remainder, that is, t[he] Rectangle* BCF, *by the kno[wn] Side* BC; *thence will arise t[he] right Line* CF. *Take t[he] Square of the Line* CF, *out [of] the Square of* AC: *The R[e]mainder will give the Square [of]* AF, *whose square Root w[ill] give the Perpendicular* A[F]. *Fig.* 12.

CA[SE]

CASE I.

The two acute Angles B *and* C, *and the Base* B A, *being given, to find the Perpendicular* C A.

1. By making the Hypothenuse B C Radius.

As the Sine of the Angle C at the Perpendicular 56°15′	9.9198464
Is to the Base AB 121.394	2.0841992
So is the Sine of the Angle B at the Base 33°45′	9.7447390
	11.8289382
To the Perpendicular AC 81.113	1.9090918

2. By making the Base AB Radius. *Fig.* 13.

As Radius A B 45° - - - -	10.0000000
Is to the Base B A 121.394	2.0841992
So is the Tangent of the Angle B 33°45′	9.8248926
To the Perpendicular A C 81.113	1.9090918

3. By making the Perpendicular A C Radius. *Fig.* 14.

As the Tangent B A of the Angle C at the Perpendicular 56°15′	10.1751074
Is to the Radius A C 45°	10.0000000
So is the Base A B 121.394	2.0821992
To the Perpendicular A C 81.113	1.9090918

In making the Proportions finding the Sides or Angles plain Triangle, it must be erved, that every Side of a Triangle has two Names, that each Side has one of Names fixed, *viz.* the *thenuse*, the *Perpendicular Base*. The other Names precarious, according to the made Radius, and are the Words on the several : Thus, when the Hypo-use is made Radius, then Word or the Hypothenuse adius, and the Word on Base is the Sine of its op- Angle; as also, the Word on the Perpendicular is the Sine of its opposite Angle; but when the Perpendicular is made Radius, then the Word on the Base is the Tangent of its opposite Angle, and the Word on the Hypothenuse is the Secant of the same Angle; and when the Base is made Radius, then the Word on the Perpendicular is the Tangent of its opposite Angle, and the Word on the Hypothenuse is the Secant of that Angle. These Things being observed, the Way to form a Proportion to find the Side of a Triangle, is thus:

First, Suppose one Side of a Trian-

Triangle to be made Radius, and observe, as above, the Word on the several Sides, the Proportion will be,

As the Word on the Side given,
Is to the given Side;
So is the Word on the Side required,
To the Side required.

Thus we see that what is sought must always stand in the fourth or last Place, and therefore, since the Perpendicular is sought, that must be the last of the four Terms; place it then with a Point of Interrogation after it, to shew it is required.

In the Rule of Proportion, the second and fourth Term being always of the same Nature, and the Perpendicular being a Length sought, and the Base the only Length given, the Base therefore must be in the second Place, and is to be wrote with four Points after it thus :: to shew that the Proportion disjoins there.

Again, we are here to observe, that the Nature of Logarithms, or their Proportion to one another, is such, that Addition serves instead of Multiplication, and Subtraction for Division: therefore the Logarithms of the two last Terms being added together, and from the Sum, the Logarithm of the first Term being subtracted, the Remainder 1.9090918 will be the Logarithm of the fourth Term, and the Number answering to that Logarithm is 81.113, which is the Perpendicular A C required.

But where Radius is not in Proportion, it may be more readily done by Addition onl for, if instead of the first Ter you set its arithmetical Co plement, that is, to write do what each Figure wants of thus the arithmetical Comp ment of 99198464, the f Term is 0.0801536, which the same as subtracting it fr 10, then add all the th Terms together, the Sum, ab ing the Radius, shall ans the Question.

2. To do the same by *Sc* and *Compasses.* Always exte the Compasses from the f Term to the Term that is the same Kind, whether it the second or third, that E tent will reach from the maining Term to the Ansv Thus, in the first Proport extend the Compasses fr 56°15′ to 33°45′ in the Lin Sines; that Extent will re in the Line of Numbers f 121.39 to 81.11 the Ansv In the second Proportion, tend the Compasses from to 33°45′ in the Line of T gents; that Extent will r from 121.39 to 81.11 in Line of Numbers. In Cases it may be needful to Cross-work, that is, to ex from the first Term in the of Sines, to the second in Line of Numbers, or from first Term in Tangents, to second in Numbers, &c. in most Cases it is bette work by the Directions ab except when the Extent i large for the Compasses.

3. By the *Sliding Rule.* pose the Line of Sines o Rule to be marked with

..d the Line of Sines on the ..lider with S. Then the first ..oportion will be thus wrought. ..et 33°45′ on S to 56°15′ on ..S; then against 121.39 on A, .. 81.11 on B. (A signifies the ..ouble Line of Numbers upon ..e Rule, and B the double ..umber on the Slider). The ..cond Proportion may be thus ..rought: Set 33°45′ in the ..angents to Radius; then a-..ainst 121.39 on A, is 81.11 on .. Or, if the Slider be so ..urned, as the Tangents and ..ouble Numbers may slide one .. another, then the Radius ..ay be set, *viz.* 45° of Tan-..ents to 121.39 in the Line of ..umbers; then against 33°45′ .. Tangents, is 81.11 in the ..ine of Numbers. The third Proportion may be wrought as this last.

To do the same Geometrically. Draw the Base B A, and from a Diagonal Scale, or Scale of equal Parts, take with the Compasses 121.39, and set from B to A, and upon A raise a Perpendicular; then take 60 Degrees from the Line of Chords with the Compasses, and set one Foot in B, describe the Arch DE, and from the same Line of Chords 33°45′ and set from D to E; and draw the Line D C, till it cut the Perpendicular in C: Then if you measure A C by the same Scale you took B A from, you will find it 81.11; and if you measure B C, you will find it 146. *Fig.* 15. The next Case will be so resolved.

CASE II.

..he two acute Angles B *and* C, *and the Base* B A *being given, find the Hypothenuse* B C. *Fig.* 12.

1. By making the Hypothenuse B C Radius.

..s the Sine of the Angle C 56°15′	9.9198464
..to the Base B A 121.394	2.0841992
..o is the Radius 90° - -	10.0000000
..o the Hypothenuse B C 146	2.1643528

2. By making the Base A B Radius. *Fig.* 13.

.. Radius B A - - -	10.0000000
..to the Base B A 121.394 - -	2.0841992
..o is the Secant of the Angle B 33°45′	10.0801536
..o the Hypothenuse B C 146	2.1643528

3. By making the Perpendicular A C Radius. *Fig.* 14.

..the Tangent of the Angle C 56°15′ Arith. Compl.	9.8248926
..to the Base B A, 121.394	2.0841992
..is the Secant of the Angle C	10.2552610
..the Hypothenuse B C 146	2.1643528

By

By Scale and Compasses.

To work the first Proportion, extend the Compasses from the Sine of 56°15′ to 90°, which Extent will reach from 121.39 to 146 in the Line of Numbers.

By the Sliding Rule.

Set 56°15′ upon S to 90° upon SS, then against 121·39 upon B, is 146 upon A. But if you turn the Slider, so as the Sines and double Numb may slide one by another, y may set 56°15′ of Sines to 1 39 in the Line of Numbe Then against 90° of Sines y will have 146 in the Line Numbers, and will find 33° of Sines to be against 81.11 Numbers. So that you m observe, if 90 of Sines be to the longest Side or Hy thenuse, you will find ev Angle against its oppo Side.

CASE III.

Two acute Angles B *and* C, *and the Hypothenuse* B C *being gi to find the Base* B A. *Fig.* 12.

1. By making the Hypothenuse B C Radius.

As Radius 90° - - - -	10 0000
Is to the Hypothenuse B C 146	2.1643
So is the Sine of the Angle C 56°15′	9.9198
To the Base B A 121.394.	2.0841

2 By making the Base B A Radius. *Fig.* 13.

As the Secant of the Angle B 33°45′	10.0801
Is to the Hypothenuse B C 146	2.1643
So is the Radius 90° - -	10.0000
To the Base B A 121·394	2.0841

3. By making the Perpendicular A C Radius. *Fig.* 14.

As the Secant of the Angle C 56°15′ Arith. Compl.	9·7447
Is to the Hypothenuse B C 146	2.1643
So is the Tangent of the Angle C 56°15′	10.1751
To the Base B A 121.394	2.0841

By Scale and Compasses.

To work the first Proportion, extend the Compasses from 90° to 56°15 in the Sines, which Extent will reach from 146 to 121.394 in the Line of Numbers.

By the Sliding Rule.

Set 56°15′ upon S to 90° on S S; then against 146 u A, is 121·394 upon B.

By Geometrical Protraction.

Draw the Line B C, and from the Scale of equal Parts take 146, and set from B to C, with 90 Degrees of Chords describe the Arch DE, and set 56°15′ from E to D, and draw C A, and from B draw B A perpendicular to A C; then when A B is measured by the Scale, it will be found to contain 121.39. *Fig.* 15.

CASE IV.

The Base B A *and the Perpendicular* C A *being given, to find the two acute Angles* B *and* C. *Fig.* 13.

1. By making the Base B A Radius.

As the Base B A 121.394	2.0841992
Is to the Radius 45°	10.0000000
So is the Perpendicular A C 81.113	1.9090918
To the Tangent A C of the Angle B 33°45′	9.8248926

Whose Complement is 56°15′ the Angle C.

2. By making the Perpendicular A C Radius. *Fig.* 14.

As the Perpendicular A C 81.113	1.9090918
Is to the Radius 45°15′	10.0000000
So is the Base 121.394	2.0841992
To the Tangent of the Angle C 56°15′	10.1751074

Whose Complement is 33°45′ the Angle B.

By Scale and Compasses.

To work the first Proportion, extend the Compasses from 121.394 to 81.113 in the Line of Numbers, that Extent will reach from 45° to 33°45′ in the Tangents. For the second Proportion, extend from 81.113 to 121.394 in the Line of Numbers, that Extent will reach from 45° to 56°15′ in the Tangents.

By the Sliding Rule.

Let the Tangents and Numbers slide together, then set 121.394 in the Line of Numbers to 45° of Tangents, and against 81.113 in the Line of Numbers is 33°45′ and its Complement 56°15′ in the Line of Tangents.

This Case is done Geometrically, as the sixth.

CASE V.

The Base BA *and the Hypothenuse* B C *being given, to find th two acute Angles* B *and* C. *Fig.* 12.

1. By making the Hypothenuse B C Radius.

As the Hypothenuse B C 146	2.164352
Is to the Radius 90°	10.000000
So is the Base B A 121.394	2.084199
To the Sine of the Angle C 56° 15′	9.919846

Whose Complement 33° 45′ is the Angle B.

2. By making the Base Radius

As the Base B A 121.394	2.084199
Is to the Radius 90°	10.000000
So is Hypothenuse 146	2.164352
To the Secant of the Angle B 33° 45′	10.080153

By Scale and Compasses.

For the first, extend the Compasses from 146 to 121.394, in the Line of Numbers, which will reach from 90° to 56° 15′ in the Sines.

By the Sliding Rule.

Set 146 upon A to 121.394 upon B, then against Radius on SS, is 56° 15′ on S.

By Geometrical Protraction.

Draw the Base B A, and from a Scale of equal Parts take 12 394 and set from B to A, an upon A raise the Perpendicul A C; then from the same Sca of equal Parts take 146, and s one Foot of the Compasses in with the other cross A C in C and draw BC. Then with 60 of Chords describe the Arch D and measure D E with the Com passes on the Line of Chord which will be 33°45′ the Me sure of the Angle B, who Complement is the Angle C *Fig.* 15.

CASE VI.

The Base B A *and the Perpendicular* C A *being given, to fi the Hypothenuse* B C. *Fig.* 16.

In this, and the next Case, we are first to find the acute Angl and from thence the third Side.

1. T

1. The Perpendicular A C being made Radius.

As the Perpendicular C A 81. 113	1.9090918
Is to the Base B A 121.394	2.0841992
So is the Radius 45°	10.0000000
To the Tangent of the Angle C 56° 15′	2.1643528

2. The Hypothenuse B C being made Radius.

As the Sine of the Angle C 56° 15′	9.9198464
Is to the Base B A 121.394	2.0841999
So is the Radius 90°	10.0000000
To the Hypothenuse 146	2.1643528

By Scale and Compasses.

Extend the Compasses from 81.113 to 121.39 in the Line of Numbers, that Extent will reach from 45° to 56°15′, in the Sign of Tangents; then extend from 56°15′ to 90° in the Sines, that Extent will reach from 121.394 to 146.

By the Sliding Rule.

Set 81.113 in the Line of Numbers to 45° in the Tangents; then against 121.39 in the Numbers is 56° 15′ in the Tangents; then set 56° 15′ on S to 90° on SS; then against 121.39 on B is 146 on A.

By Geometrical Protraction.

Draw the Line B A, and from a Scale of equal Parts take 121.394 in the Compasses, and set from B to A, and upon A erect the Perpendicular A C; and from the same Scale take 81.113, and set from A to C; then draw the Hypothenuse B C, take B C in the Compasses, and on the Scale it will be found 146. Then with 60° of Chords describe the Arch D E. measure DE with the Compasses on the Line of Chords, which will be 33° 45′ the Measure of the Angle B, whose Complement is the Angle C. *Fig.* 15.

CASE VII.

The Base B A, *and the Hypothenuse being given, to find the Perpendicular* A C. *Fig.* 12.

1. The Hypothenuse B C being made Radius.

As the Hypothenuse B C 146	2.1643528
Is to the Radius 90°	10.0000000
So is the Base B A 121.394	2.0841992
To the Sine of the Angle C 56° 15′	9.9198464
Whose Complement is the Angle B 33° 45′	

2. The

2. The Hypothenuse B C being made Radius.

As Radius 90	10.00000
Is to the Hypothenuse B C 146	2.16435
So is the Sine of the Angle B 33° 45′	9.74473
To the Perpendicular A C 81.113	1.90909

By Scale and Compasses.

For the first Operation, extend the Compasses from 146. to 121.394 in the Line of Numbers, that Extent will reach from 90° to 33° 45′ in the Sines. Then for the second Operation, extend the Compasses from 90° to 33° 45′ in the Sines, that Extent will reach from 146 to 81.113 in the Line of Numbers.

By the Sliding Rule.

For the first, set 146 on A to 121.394 on B, then against 90 on SS there will be found 56° 15′ on S. Then for the second, set 90° on SS to 33° 45′ on S and against 146 on A, 81.113 on B.

By Geometrical Protraction.

Draw the Line A B, and from the Scale take 121.394, which set from B to A, and upon A raise the Perpendicular A C, then from the Scale take 146, and set one Foot of the Compasses B, cross the Perpendicular in C, and measure A C on the Scale, which will be 81.113. *Fig.* 15.

Th

The Seven Cases of Plain Triangles.

See *Plate*, *Fig.* 8.

Right Angled.

Cases.	Given.	Required.	Proportions.
I.	A B and B	A C	1. s C : B A : : s B : A C. 2. R : B A : : t B : A C. 3. t C : B A : : R : A C.
II.	A B and C	B C	1. s C : BA : : R : B C. 2. R : BA : : se B : B C. 3. t C : BA : : se C : B C.
III.	B C and B	B A	1. R : B C : : s C : B A. 2. se B : B C : : R : B A. 3. se C : B C : : t C : B A.
IV.	A B and A C	B and C	1. BA : R : : A C : t B. whose Complement is C. 2. CA : R : : B A : t C. whose Complement is B.
V.	B C and A C	B and C	1. BC : R : : BA : s C whose Complement is B 2. BA : R : : BC : se B whose Complement is C
VI.	A B and A C	B C	1. CA : BA : : R : t C. Then again, 2. s C : BA : : R : BC.
VII.	A B and B C	A C	1. BC : R : : BA : s C whose Complement is B Then again, 2. R : B C : : B : s A C.

§. III.

§. III. *Of solving Oblique Angled* Triangles.

Case I.

The Angles C A B *62° 30′ and* C B A *37° 30′ and the Side* A C *350 Feet being given, to find the other two Sides* C B *and* A B, *Fig.* 17.

As the Sine of the Angle C B A 37° 30′ Arith. Compl.	0.215552
Is to the Side A C 350.	2.544068
So is the Sine of the Angle C A B 62° 30′	9.947928
To the Side B C 509.976.	2.707549

For the Side A B.

As the Sine of the Angle C B A 37° 30′ Arith. Compl.	0.215552
Is to the Side A C 350	2.544068
So is the Sine of the Angle A C B 80°	9.993351
To the Side A B 566.203	2.752972

The Parts required in the several Cases of oblique Trigonometry, may be found with the Scale and Compasses, by extending the Compasses from the first Term of the Proportion, to the second, and the same Extent will reach from the third Term to the fourth required. Also the Parts required may be found by the Sliding Rule, by setting the first Term against the second, then opposite to the third Term, the fourth Term may be found.

Case II.

The two Sides A C *350 and* C B *509.976, and the Angle* C A B *62° 30′ opposite to one of the given Sides,* C B *being given, to find the Angle* C B A *opposite to the other Side* A C. *Fig.* 17.

As the Side B C 509.976 Arith. Compl,	7.292450
Is to the Sine of the Angle A 62° 30′	9.947928
So is the Side A C 350	2.544068
To the Sine of the Angle B 37° 30′	9.784447

Or

Or, if the two Sides A B and B C and the Angle opposite to the Side B C had been given, and the Angle C had been required; then,

As the Side B C 509.976 Arith. Compl.	7.2924502
Is to the Sine of the Angle A 62° 30′	9.9479289
So is the Side A B 566.203	2.7529724
To the Sine of the Angle C 80°	9.9933515

CASE III.

The Side A B 566.203, *the Side* A C 350, *and the Angle* A 62° 30′ *comprehended between the Sides* A B *and* A C *being given, to find the Angles* A C B *and* A B C. *Fig.* 17.

	A B=566.203		180°
	A C=350	Subt.	62 30′
The Sum	916.203	Rem.	117 30=Sum of the Angles B and C.
Diff.	216.203		58 45= half the Sum.

As 916.203 the Sum of the Sides Arith. Compl.	7.0380083
Is to 216.203 the Difference of the Sides	2.3348617
So is the Tangent 58° 45′ half the Sum of the opposite Angles	10.2169438
To the Tangent 21° 15′ half the Difference of the opposite Angles, (by *Theor.* 3. *Sect.* 11.)	9.5898138

If 21° 15′ be added to 58° 45′ the Sum will be 80° the Angle ACB; and if 21° 15′ be subtracted from 58° 45′, the Remainder will be 37° 30′ the Angle A B C.

CASE IV.

The Side AB 566.203, *the Side* B C 509.976 *and the Angle* B 37° 30′ *comprehended between the Sides* A B *and* A C *being given, to find the third Side* A C. *Fig.* 17.

The Side A B	566.203	180° 00
The Side B C	509.976	37 30
The Sum	1076.179	142° 30
Difference	56.227	71° 15′

As

As 1076.179 the Sum of the Sides Arith. Compl.	6.96811
Is to the Difference 56.227	1.749944
So is the Tangent of half the Sum of the opposite Angles	10.469218
To the Tangent 8° 45′ half the Difference of the opposite Angles (by *Theor.* 3. *Sect.* II.)	9.187179

If 8° 45′ be added to 71° 15′, the Sum will be 80° th greater Angle C, and being subtracted the Remainder 62° 30 the lesser Angle A. Then,

As the Sine of the Angle A 62° 30′ Arith Compl.	0.052071
Is to the Side B C 509.976	2.707549
So is the Sine of the Angle B 37° 30′	9.784447
To the Side A C 350, which is required (by *Case* I. *Sect.* III.	2.544068

CASE V.

The three Sides A B 213.5, A C 103.5, *and* B C 250.2 *of a oblique Triangle* A B C *being given to find the three Angles* *Fig.* 18.

As the greatest Side C B 250.2 Arith, Compl.	7.601712
Is to the Sum of the other two Sides A B and A C 321.	2.506505
So is the Difference B E 106 of the two Sides A B and A C.	2.025305
To the Difference B F 135.995 of the Segments of the Base.	2.133523

Which Difference 135.995, subtracted from B C 250.2 the greatest Side, leaves F C 114. 205, the half whereof is G C 57.1025 the lesser Segment; which if subtracted from B C 250.2, the Remainder B G will be 193.0975, the greater Segment of the Base. Thus the oblique Triangle is reduced into two right-angled Triangles, *viz.* A B G and A G C both right-angled at G, in each of which there is given the Hypothenuse and Base: So the Angles may be found by (Case V. *Of right-angled plain Triangles*) thus:

As the Hypothenuse A B 213.5	2.3293979
Is to the Radius	10.0000000
So is the Base B G 193.0975	2.2857762
To the Sine of the Angle B A G 64° 44′ 51″	9.9563783

The Complement of B A G is A B G 25° 15′ 9″

Again,

Again, in the Triangle A C G.

the Hyyothenuse A C 107.5	2.0314085
to the Radius	10.0000000
is the Base G C 57.1025	1.7566552
the Sine of the Angle G A C 32° 5′ 8″	9.7252467

The Complement of G A C is A C G 57° 54′ 52′.

This Case is demonstrated from the fourth Theorem of Sect. II.

The Five Cases of oblique-angled Triangles.
See *Plate, Fig.* 9.

Cases.	Given.	Required.	Proportions.
I.	A C A and B	A B	s B : A C : : s C : A B.
II.	A C C B and B.	A	C A : s B : : C B : s A.
III.	A C C B and C.	A and B	C B + C A : C B — A C : : t ½ A + B : t ½ the Difference, which ½ Dif. {added to / sub. from} the ½ Sum giv. the {greater / lesser} Angle.
IV.	A C C B and C.	A B	Find the Angles A and B by the last Case; then, by the first Case, the Side A B will be found.
V.	A B A C and C B.	A, B and C.	B C : A B + A C : : A B — A C : B F. Then B C — B F = F C and ½ F C is C G.

§. I. Of

§. I. *Of Trigonemetrical* Problems.

PROB. I.
To measure an accessible Altitude.

Let AB *represent a Tower, Steeple,* &c. *whose Height required?*

First, with the Quadrant, or other Instrument, find t Quantity of the Angle C, which suppose to be 52° 30′, then me sure the Distance A C; which suppose to be 85 Feet; then *Case* I. of plain Triangles:

As the Sine of the Angle C B A 37° 30′ Arith. Compl.	0.215
Is to the Base A C 85 Feet	1.9294
So is the Sine of the Angle C 52° 30′	9.8994
To the Altitude A B 110.8	2.0444

Or thus,

As Radius	10.000
Is to the Base A C 85	1.9294
So is the Tangent of the Angle C 52° 30′	10.115
To the Altitude 110.8	2.0444

Note, *That in this, and all such Cases, you must add* t *Height of your Eye, or Instrument to the Altitude before foun*

PROB. II.
To measure an inaccessible Altitude.

Let A B *be a Church Steeple, whose Height is required; but by reason of a River, or some other Obstacle, you cannot come to the Foot of it at* A.

First, Take, with the Quadrant at C, the Angle of Altitude, which, suppose to be 26° 30′; then measure in a right Line towards the Steeple to D, which suppose to be 75 Feet, and at D again observe the Angle of Altitude, which, let be 51° 30′.

Now the two visual Lines B and D B, and the measu Distance C D form the obliq angled Triangle C B D, whe in are given all the Angles, a the Side C D, the Angle B C being 26° 30′ and the Comp ment of A D B 51° 30′ to is the obtuse Angle B D C 1 30′, and consequently, the th Angle C B D is 25°. But t Angle may be more read found by subtracting B C from A D B (by *Euclid.* l Prop. 32.) Then by Case I. *oblique, angled plain Triang* find the Side B D; Thus:

As the Sine of the Angle CBD 25° 30′.	0.374052
Is to the Distance of CD 75	1.875067
So is the Sine of the Angle C 26° 30′	9.649527
To the visual Line BD 79.18	1.898640

Then by Case I. *Of right-angled plain Triangles.*

As Radius	10.000000
Is to BD 79.18	1.989640
So is the Sine of the Angle ADB 51° 32′.	9.893544
To the Altitude AB 61.97.	1.729184

PROB. III.

To measure the Height of a Steeple, Tower, &c. standing upon a Hill.

First, Find the Angle CAB 44° and the Angle EAB 26°; then measure in a strait Line towards the Steeple from A to D 134 Feet: Then again at D, find the Angle CDB 67° 50′, and the Angle EDB 51°. By Case I. *Of oblique plain Triangles*, find the visual Line CD in the Triangle ACD, wherein are given the Angles DAC and ACD and the Side AD; Thus:

As the Sine of the Angle ACD 23° 51′	3.393536
Is to the measured Distance AD 134	2.127105
So is the Sine of the Angle CAD 44°	9.841771
To the Side CD 230.4	2.362412

Then, as Radius	10.000000
Is to the Side CD 230.4	2.362412
So is the Sine of the Angle CDB 67° 50′.	9.966653
To the Side BC 213.3	2.329065

Again, As Radius	10.000000
Is to the Side CD 230.4	2.362412
So is the Sine of the Angle BCD 22° 10′.	9.576689
To the Base BD 86.92	1.939101

Lastly, As Radius	10.000000
Is to the Base BD 86.92	1.939101
So is the Tangent of the Angle BDE 51′.	10.091631
To the Perpendicular BE 107.3	2.030732

From the whole perpendicular Height BC
Subtract the Perpendicular Height of the Hill B E

There remains the Height CE of the Steeple

PROB. IV.

One Side B C 532 *of an oblique Triangle* A B C, *the Angle* A 110° 30′ *opposite to that Side, and the Sum of the other two Sides* A B *and* A C 637 *being given, to find the other two Sides and the Angles severally.* See Plate, Fig. 22.

Extend the Side B A to D, make A D equal to A C and draw D C, so there will be other two oblique-angled Triangles B D C and A D C. In the Triangle A B C is given, the Angle B A C 110° 30′, and the Triangle A C D is given the Angle C A D 69° 30′ the Complement of the other to 180, also the Triangle A D C is equicrural by Construction, therefore the Angles C and D at the Base are equal, and each of them is equal to ½ the given Angle B A C (by Prop. 32. *Euclid.* l. 1.) Now in the Triangle B C D there is given B C 532, B D 637, and the Angle B D C 55° 15′. Whence the Angle D C B may be found (by Case ... *Of oblique Triangles.*)

As the Side of B C 532 Arith. Comp.	7.27408
Is to the Sine of the Angle B D C 55° 15′	9.9146[illegible]
So is the Side B D 637	2.8041[illegible]
To the Sine of the Angle B C D 100° 19′	9.99291

From which subtract the Angle A C D 55° 15′, and the Remainder is 45° 4′ for the Angle A C B, and the Angle is 24° 26′, which is found by subtracting the Sum of B C D 100° 19′, and D 55° 15′ from 180. The Sides A B and A C, are found (by Case I. *Of oblique Triangles*).

As the Sine of the Angle B A C 100° 30′ Arith. Compl.	0.02841
Is to the Side B C 532	2.72591
So is the Sine of the Angle A C B 45° 4′	9.8499[illegible]
To the Side A B 402.08	2.60431

Again, As the Sine of the Angle B A C 110° 30′ Arith. Compl.	0.02841
Is to the Side B C 532	2.72591
So is the Sine of the Angle A B C 24° 26′	9.61661
To the Side A C 234.93 -----	2.37094

PRO

PROB. V.

e Side B C 250.2 *of an oblique Triangle* ABC, *the Angle* B A C 96° 50′ *opposite thereto, and the Difference of* B D 106, *of the other two Sides* A B *and* A C *being given, to find the Angles* B *and* C, *and the two Sides severally.* See Plate, Fig. 23.

Make A D equal to A C, and draw C D; the Angle D A C ing 96° 50′, the Complement thereof to 180° is 83° 10′ for the Angles A D C and A C D; which being equal one to the er, therefore each of them is half of 83° 10′; and by draw- C D there is also another Triangle made, wherein is given C 250.2 and B D 106, equal to the Difference of the two Sides B and A C; and there is also given the Angle B D C 138° 25′, al to the Complement of 41° 35′

the Side B C 250.2 Arith. Compl.	7.6017127
to the Sine of the Angle B D C 138° 25′	9.8219775
is the Side B D 106	2.0253059
the the Sine of the Angle B C D 16° 19′ 52″	9.4489961

To which if A C D 41° 35 be aded the Sum of the Angle C B will be 57° 54′ 52″: and if A be added to it, and the m subtracted from 180, there will remain the Angle A B C 15′ 8″. Find the Sides A B and A C, as in the last Problem; us:

the Sine of the Angle B A C 96° 50′ Arith. Compl.	0.0030960
to the Side B C 250.2	2.3982873
is the Sine of the Angle A C B 57° 54′ 52″	9.9280146
the Side A B 213.5	2.3293979

Again,

the Sine of the Angle B A C 96° 50′ Arith. Compl.	0.0030960
to the Side B C 250.2	2.3982873
is the Sine of the Angle A B C 25° 15′ 8″	9.6300247
the Side A C 107.5	2.0314080

PROB. VI.

e right angled Triangle A B C *there are given, Base* A B *and the Sum of the Perpendicular* A C, *and Hypothenuse* D 200, *to find the Perpendicular* A C *and Hypothenuse* C B *verally.* See Plate, Fig. 24.

the Triangle A B D is given the Base and Perpendicular, d the Angles A B D and A D; Thus:

As the Base A B 40 | 1.6020
Is to the Radius 45 | 10.0000
So is the Perpendicular A D 200 | 2.3010

To the Tangent of the Angle A B D 78° 41′ 24″ | 10.698

Whose Complement is the Angle D 11° 18′ 36″, and bec
C D is equal to C B, therefore the Angle C B D is also 11°
36″; then if 11° 18′ 36″ be subtracted from the whole A
78° 41′ 24″ there will remain the Angle A B C 67° 22′
Then to find the Sides.

As Radius | 10.000
Is to the Base | 1.602
So is the Tangent of the Angle A B C 67° 22′ 48″ | 10.380

To the Perpendicular A C 96 | 1.982

Then subtract 96 from 200, and there will remain the
pothenuse B C 104

PROB. VII.

Let B E *and* D *be three Objects, whose Distances are known, and* C *a Station from which all the Objects may be seen, and the Angles with each Object may be found. What is the Distance of each Object?* See Plate, Fig. 25.

B D 106, B E 53 25 D E 65, 5 *the Angles* B C E 13° 30′ *and* D C E 29° 50′ *are given, to find* B C, E C *and* D C.

The three Angles of the Triangle B D E *are found by* Case V. *Of oblique angled Triangles.*

Thro' the three Points B, D, and C describe a Circle, draw the Lines B C, D C and E C, which last continue to F, where it cuts the Circle, draw B F and D F. Then 180 — Angle B C D = Angle B F D = 136° 40′ (by Prop. 32. *Euclid.* l. 1.) and the Angle B D F = Angle B C F (by Prop. 21. *Euclid.* l. 3.) and so the Angle D B F = Angle D C F. In the Tria
B F D all the Angles are gi
and the Side B D, to find B
36, 059 to D F = 76, 843
Case I. *Of oblique angled*
angles.) Then the Angle
Angle B D E = F D E;
in the Triangle F D E, are
ven the Sides E D, F D, an
included Angle F D E, to
the Angle F E D = 84° 30
and 180 — Angle F E D =
29′ 36″; then in the Tri
E D C all the Angles, an
Side D E are given, to
E C = 107, 42 and D C =
05. Lastly, In the Tri
B D C all the Angles and
two Sides B D and D C ar
ven, to find the third Side
151.3.

PROB. VIII.

Suppose B *and* D *two Sta*
whose Distance is 47.5
from whence the two O
C *and* E, *may be seen, and*
Angles found by Observ
viz. C B E 49°, E B

CDD 32°, *and* CDE 56° *is required to find* BC, BE, DC, DE *and* CE. See Plate Fig. 26.

In the Triangle CBD, the e BD and all the Angles are en, to find BC = 28, 7795, DC = 54. 2349, (which done by Case I. *Of oblique* led *Triangles*) and in the angle BED are given the e Things, to find BE = 58, s and DE = 36, 1475, (by same Case.) Lastly, In the iangle BCE are given, BC and the included Angle CBE ind CE = 45,3378, (by Case . *Of oblique angled Triangles*.

PROB. IX.

C *and* E *be two Objects, whose Distance is known, and* et B *and* D *represent two Stations, from whence they* ay *be both seen, and the horizontal Angles* CBE *and* DBE, CDE *and* CDB *found* y *Observation; but the Distance of the two Stations can*not *be measured, What is the Distance of the two Stations, and the Objects from each Station?* See Plate, Fig. 27.

Draw another Figure c e d b, se Side d b, suppose to be Number, as 10, and simi- to CEDB; now, upon Sup- tion, that b d is 10, and the ll Figure similar to the t one, we can, by the last blem, find de = 7,61, be = 53116, bc = 6,05885, d c 1,41787, and c e = 9,5448. , if by working in this ner, c e had been found = =45,3378, then it is plain, all the Side had been exactly found; but as it has not been found by similar Triangles, the true Sides may be found by those already discovered, thus, as, c e : CE : : c b : CB = 28, 7795; and as, c e : CE : : c d : CD; and c b : CB : : b d : BD = 47,5; and as, c e : CE : : e d : ED = 36,147; and so of the rest.

LOGARITHMS.

Purposing to give you the Solution of some of the Questions in this Book by those excellent Numbers the Logarithms; take these Directions for the better nnderstanding the Nature and Use of them.

They are artificial Numbers, fitted to the natural, for the Ease of Calculation; and are printed in Tables having two Columns. One hath the natural Number; against it in the other is his Logarithms: So that the Logarithm of a whole Number is easily found.

The Tables begin at 1, whose Logarithm is 0,00000; and reach commonly to 10,000; consisting every one of 8 Figures, though (unless in great Numbers) we seldom use above six; (if the Figures left out exceed 50, we put an Unite to the sixth) to the Logarithms are annexed Differences; by the Help of which, and a Table of proportional Parts adjoined, you are directed to find the Logarithm of any Number to 100,000. But these are but of 7 Places.

Mr. *Wingate*, in his *Tabulæ Logarithmicæ*, hath the Logarithms to 100,000 with Differences alſo; whereby making a Proportion, (which is done ſpeedily by one Slip of this Rule) you have the Logarithms as far as 1,000,000 in a portable Volume for the Pocket. A Book which I commend to any that delight in Arithmetick.

The firſt Figure, called the Index, (which is commonly ſeparated by a Point, better left out, except in the firſt hundred, as in the late printed Tables) ſhews how many Figures the anſwering Number, if whole, or the whole Part thereof, if it hath a Decimal annexed, conſiſteth of; which are always more by one than the Index. So 0, is the Index of one Figure, 1 of two Figures, 2 of three, 3 of four, &c.

Alſo according to the excellent Way of Mr. *Chriſtopher Townly*, cited by Sir *Jonas Moor* in his Mathematical Compendium, the Log. of a Decimal is the ſame, as if it were a whole Number, with this Direction for the Index.

If the Decimal be of the firſt Rate, the Index is 9; if of the ſecond Rate, the Index is 8; if of the third Rate, the Index is 7, &c. that is, the Index of the Logarithm of any Decimal, wants as many Units of ten, as the left Hand ſignificant Figure is diſtant from Unity: Which, I hope, you will underſtand, if you obſerve this following Table.

Perf. Numb.	*Log.*
3536.	3.54851
353.6	2.54851
35.36	1.54851
3.536	0.54851
Decimals.	*Log.*
.3536	9.54851
.03536	8.54851
.003536	7.54851
.0003536	6.54851

Where you ſee, That in t[he] perfect Numbers, the Ind[ex] ſheweth the Number of Plac[es] in the whole Numbers, and the whole Part of the mixt, b[e]ing always leſs by one than t[he] ſaid Places; but in Decimals ſheweth the Rate, being t[he] Complement thereof to Te[n] not regarding the Number [of] Places.

If then you would have t[he] Log. of any Number, find t[he] Log. thereof in the Table, as it were whole; and prefix t[he] Index anſwering the Value.

And having a Log. find t[he] Number anſwering in the Tabl[e] and by a Point fix the Valu[e] according to the Index.

To find a Log. to a Number [of] ſix Places in the Tabulæ Logarithmicæ *by Help of th[is] Rule.*

Call the Difference at t[he] Bottom the Tabular Differe[n]ces. Having the Log. of t[he] five firſt Figures, by the doub[le] Scale on your Rule, ſet 10 t[o] the Tabular Differences; a[nd]

gain

inst your sixth Figure is his roportional Part to be added to e Log. before found.

o find a Number of six Places answering a Log. given.

Find the Number of five Plas answering the Log. in the able, next less to the given og. subtract the said Log. out f the given Log. call the Remainder the proper Difference; hen by the double Scale on your ule set 10 to the Tabular ifference; against the proper ifference on the second, is your xth Figure on the first, to be nexed to the five Figures bere found.

Note, That you must use all e eight Figures in these Cases.

Some Uses of the Logarithms.

Whereas, before the aforesaid ontrivance of the Indices by r. *Townley*, if one Number ere perfect, and the other Decimal, there was a diffent Rule in every Operation r them; but by the said Conivance one is now sufficient: will give Examples only, in hich one Number is a Decial, with these two Directions.

1. In the Log. which answer the Question, (whether it a Sum, Remainder, Half, c.) if the Index be ten, or ave, neglect or cancel the said gure in the Place of Tens.

2. Where you are ordered to btract a greater Log. out of ess; add ten to the Index of less, and then subtract.

1. Multiplication.

Add the Logs. of the two, or more Numbers to be multiplied; the Sum is the Log. of the Product. So 12 multiplied by the Decimal 25, the Product is 3.

	12.	1 07918
By	.25	9.39794
	3.	1 047712

It may also be done where there are but two, by subtracting the Arithmetick Complement of the Log. of one of them out of the Log. of the other; the Remainder is the Log. of the Product.

Which Arithmetical Complement is the Remainder of every Figure, (including the Index) to 9; except of the last significant Figure to the right Hand, whose Remainder you must take to Ten. As in these three Examples.

Numb.		
2.	0.30103	*Log.*
.5	9.69897	*Ar. Compl.*
Numb.		
80.	1.90309	*Log.*
.0125	8.09691	*Ar. Compl.*
Numb.		
100	2.00000	*Log.*
.01	8.00000	*Ar. Compl.*

2. Division.

Subtract the Log. of the Divisor out of the Log. of the Dividend, (whether of the two be

be greater or leſs) the Remainder is the Log. of the Quotient. So 12 divided by the Decimal .25; the Quotient is 48.

	12.	1.07918
By	.25	9.39794
	48.	1.68124

It may alſo very conveniently be done, by adding the Ar. Compl. of the Log. of the Diviſor to the Log. of the Dividend; the Sum is the Log. of the Quotient, as followeth.

3. *The Rule of Three Direct.*

1. Add the Logarithms of the ſecond and third; from the Sum ſubtract the Log. of the firſt; the Remainder is the Log. of the fourth.

2. A better Way: Add the Ar. Compl. of the Log. of the firſt to the Logarithms of the ſecond and third; the Sum is the Log. of the fourth. *Example.* If .25 give 16. What ſhall 12. give?

Ar. Compl.	.25	0.60206
	16.	1.20412
	12.	1.07918
	768.	2.88536

Anſ. 768.

But in the inverſe Rule: Add the Ar. Compl. of the Log. of the third to the Logarithms of the firſt and ſecond; the Sum is the Log. of the fourth. Thus are reſolv'd the Queſtions wrought on the double Sc

But for thoſe in this Bo where there is a duplicate P portion, as in Timber Meaſ and Gauging, if the firſt a third Numbers be on the ſqu Line, there are general or fi Logarithms belonging to firſt Numbers; to which if y add the Log. of the ſecond, a the Log. of the third twice, Sum of all four is the Log. the fourth.

If the ſecond and fou Numbers be on the ſqua Line; to the Ar. Compl. the Log. of the firſt, add Log. of the third, and the Lo of the ſecond twice, half t Sum is the Log. of the fourt

4. *The Square Root.*

Half the Log. of the Nu ber given, is the full Log. the Square Root.

If the Number be a Decim add ten to the Index, and th halve it, as here.

.25	19.39794
.5	9.69897

5. *The Cube Root.*

The third Part of the Lo of the Number given, is the fu Log. of the Cube Root.

If the Number be a Decima add twenty to the Index, a then divide by three, as here

.25	29.39794
.63	9.79931

To find a mean Proportional between two Numbers.

Add their Logs. together: Half the Sum is the Log. of the mean Proportional.

When one is a Decimal, if the Sum of the Indices be ten, (as here) or above; cast away ten, and then halve it; if it be not ten, add ten to it, and then halve it.

12.	1.07918
.25	9.39794
	10.47712
1.732	0.23856

To find two, or more mean Proportionals between two Numbers.

This, in Case of a Decimal, was something perplex'd, as you may see in Mr. *Wingate*'s Artificial Arithmetick: It is now, by the aforesaid Contrivance of Mr. *Townley*, as easy, as it is useful.

Subtract the Log. of the less Number out of the Log. of the greater: The Remainder divide by a Number greater by one, than the Number of Means sought; as here, by 4 for three Means.

12.	1.07918
.25	9.39794
	1.68124
	42031

This Quotient added to the Log. of the less Number; the Sum is the Log. of the first Mean; to which adding again the said Quotient, the Sum is the Log. of the second Mean. And so forward for as many Means, as the Quotient was at first ordered for.

Means.		
		9.39794
		42031
1	.658	9.81825
		42031
2	1.732	0.23856
		42031
3	4.556	0.65887

8. *To find the Log. of a Vulgar Fraction.*

Subtract the Log. of the Denominator out of the Log. of the Numerator, the Remainder is the Log. of a Decimal equivalent to the said vulgar Fraction.

$\frac{3}{4}$	0.47712
	0.60206
.75	9.87506

9. *To find the Log. of a Number with a Vulgar Fraction annex'd.*

Suppose it to be 12 $\frac{1}{4}$; change the Number into an improper Fraction, by multiplying the whole Number by the Denominator of the Fraction, and adding the Numerator to the Product,

duct, the Sum is the Numerator of the improper Fraction.

$\frac{49}{4}$	1.69020
	0.60206
12.25	108814

Then subtract the Log. of the Denominator out of the Log. of the Numerator, as before; the Remainder is the Log. of the said Number, with a Decimal, equal to the said vulg Fraction, annexed.

I have, as an Appendix this Part, adjoined the usu Decimal Tables, and comp sed them into five: Yet t Use of them is as easy, as if th were all single.

The Integers, or Wholes, a set on the Top; and the Par follow in order, with their D cimals annexed.

TABLE

TABLE I.

A Table of English *Coin, a Pound Sterling, also Troy Weight, an Ounce* } *Integer.*

Shillings and Penny Weight.	Decimals.	Pence with Farthings.	Decimals.	Grains.	The Residue of the Table. Pence with Farthings.	Decimals.	Grains.
19	.95	3	.0489583		5	.0201333	10
18	.9	2	.0479166	23	3	.0197916	
17	.85	1	.046875		2	.01875	9
16	.8	11	.0458333	22	1	.0177083	
15	.75	3	.0447916		4	.0166666	8
14	.7	2	.04375	21	3	.015625	
13	.65	1	.0427083		2	.0145833	7
12	.6	10	.0416666	20	1	.0135416	
11	.55	3	.040625		3	.0125	6
10	.5	2	.0395833	19	3	.0114583	
9	.45	1	.0385416		2	,0104166	5
8	.4	9	.0375	18	1	,009375	
7	.35	3	.0364583		2	.0083333	4
6	.3	2	.0354166	17	3	.0072916	
5	.25	1	.034375		2	.00625	3
4	.2	8	.0333333	16	1	.0052083	
3	.15	3	.0322916		1	.0041666	2
2	.1	2	.03125	15	3	.003125	
1	.05	1	.0302083		2	.0020833	1
		7	.0291666	14	1	.0010416	½
		3	.028125		½	.0005208	½
		2	.0270833	13			
		1	.0260416				
		6	.025	12			
		3	.0239583				
		2	.0229160	11			
		1	.021875				

TABLE II.

Averdupois *great Weight, One hundred at* 112 l. *Integer.*

Quarters.	Decimals.
3	.75
2	.5
1	.25
Pounds.	**Decimals.**
27	.2410714
26	.2321428
25	.2232143
24	.2142857
23	.2053571
22	.1964286
21	.1875
20	.1785714
19	.1696428
18	.1607143
17	.1517857
16	.1428571
15	.1339286
14	.125
13	.1160714
12	.1071428
11	.0982143
10	.0892857
9	.0803571
8	.0714286
7	.0625
6	.0535741
5	.0446428
4	.0357143
3	.0267857
2	.0178571
1	.0089286

The Residue of the Table.

Ounces.	Decimals.
15	.0083705
14	.0078126
13	.0072545
12	.0066964
11	.0061384
10	.0055803
9	.0050223
8	.0044643
7	.0039062
6	.0033482
5	.0027902
4	.0022321
3	.0016741
2	.0011161
1	.000558
Quarters.	**Decimals.**
3	.0004185
2	.000279
1	.0001395

TABLE III.

Averdupois *little Weight, one Pound long Measure, one Yard or Ell,* } *Integer.*

Ounces.	Decimals.	Qtrs. with Nails.
15	.9375	3
14	.875	2
13	.8125	1
12	.75	3
11	.6875	3
10	.625	2
9	.5625	1
8	.5	2
7	.4375	3
6	.375	2
5	.3125	1
4	.25	1
3	.1875	3
2	.125	2
1	.0625	1

The Residue of the Table.

Drams.	Decimals.	Qtrs. of Nails.
15	.0585937	
14	.0546875	
13	.0507812	
12	.046875	3
11	.0429687	
10	.0390625	
9	.0351562	
8	.03125	2
7	.0273437	
6	.0234375	
5	.0195312	
4	.015625	1
3	.0117187	
2	.0078125	
1	.0039062	

Qtrs.	Decimals.
3	.0029297
2	.0019531
1	.0009765

TABLE IV.

Liquid Measure, one Gallon. } *Integer.*
Dry Measure, one Quarter.

Pints.	Decimals.	Bushels.
7	.875	7
6	.75	6
5	.625	5
4	.5	4
3	.375	3
2	.25	2
1	.125	1
Quarters.	**Decimals.**	**Pecks.**
3	.09375	3
2	.0625	2
1	.03125	1
	Decimals	**Quarters of a Peck.**
	.0234375	3
	.015625	2
	.0078125	1
	Decimals	**Pi n**
	.0058594	3
	.0039063	2
	.0019531	1

TABLE V.

Dozens, or Gross }
Time, one Year. } *Integer.*
Long Meas. 1 Foot. }
Pence 1 Shilling. }

Dozens. Months	Decimals.	Inches Pence.
11	.9166667	11
10	.8333333	10
9	.75	9
8	.6666667	8
7	.5833333	7
6	.5	6
5	.4166667	5
4	.3333333	4
3	.25	3
2	.1666667	2
1	.0833333	1
Parts.	**Decimals.**	**Quarters & Farth.**
11	.0763889	
10	.0694444	
9	.0625	3
8	.0555555	
7	.0486111	
6	.0416667	2
5	.0347222	
4	.0277778	
3	.0208333	1
2	.0138889	
1	.0069444	

Days

Days belonging to the Table of Time.

Days.	Decimals.	Days	Decimals.
30	.08219178	15	.0410959
29	.079452	14	.0383562
28	.0767123	13	.0356164
27	.0739726	12	.0328767
26	.0712329	11	.030137
25	.0684931	10	.0273972
24	.0657534	9	.0246575
23	.0630137	8	.0219178
22	.060274	7	.0191781
21	.0575342	6	.0164383
20	.0547945	5	.0136986
19	.0520548	4	.0109589
18	.0493151	3	.0082192
17	.0465753	2	.0054794
16	.0438356	1	.0027397

obring Decimals into known Parts.

Multiply the Number of Parts one Integer, and the Deci- als together: From the Pro- uct cut off so many Figures to e right Hand as are in the De- mals (as you are directed in ultiplication of Decimals.) he Residue to the left Hand e the Parts sought; and the gures cut off are a Decimal one of those Parts, to be re- uced the same way into the xt less Parts, if there be any, if there be need. If nothing left to the left Hand, there is not one of those Parts in that Decimal: Therefore account it cut off, and proceed to find the next less Parts, as before.

The making the foregoing Tables is by dividing the Numerator of the vulgar Fraction, which represents the Parts, by the Denominator; the Quotient is the Decimal. So $\frac{11}{20}$ being the vulgar Fraction of 11 Shillings, or 11 Penny-weights; if you divide 11 by 20, the Quotient .55 is the Decimal: So that half the Number of Shillings or Penny-weights is the Decimal. Also $\frac{26}{960}$ being the vulgar Fraction of *6 d.* ½ or of 26 Farthings; if you divide 26 by

by 960, the Quotient .0270830, &c. is the Decimal.

Yet you shall not need Division for every Decimal; for some are found by halving the Integer or 1: and so continually: So are found the Decimal of one half, one quarter, one half quarter, &c. Some are found by halving a Decimal before found: So half the Decimal of a Shilling, is the Decimal of Six-pence; half of that the Decimal of Three-pence, &c. Also one third Part of the Decimal of a Shilling, is the Decimal of Four-pence; and the half of that, the Decimal of Two-pence, &c. and the double of it the Decimal of Eight-pence. Likewise the Sum of two Decimals, is the Decimal of the Sum of the two Fractions whose Decimals they are; and the Difference is the Decimal of their Difference.

Some of these are of one Place, and some of more: Few Tables have them to above seven; and most ordinary Questions may be resolved to a sufficient Exactness, if you use but four; remembering the Direction above given, *viz.* If the first Figure of those left out exceed 5, to add a Unite to the last of those you retain.

If the Answer of a Question be in Money, three Places of Decimals give it to near a Farthing, as is shewn after *Part* 4. *Prop.* 5.

Now for the Use of them in a Question or two.

1. At 5 *s.* 3 *d.* $\frac{1}{2}$ the Ounce, what cost 7 Ounces, 3 Pennyweight, and 19 Grains?

Having added the Decimals of the Parts, the Question will stand thus:

ou.	*l.*	*ou.*	*l.*
1 :	0.2645833 ::	7.1895833 :	1.9022

The Product or Answer is 1 *l.* 9022, &c. Which is 1. *l* 18 *s.* 0 *d.* 2 *f.* near.

If you leave out the three last Figures in each Decimal, with the Condition abovementioned, the Numbers are

ou.	*l.*	*ou.*
1 :	0.2646 ::	7.1896

And the Answer is 1 *l.* 9023. &c. differing from the other in- considerably.

2. To compute simple Interest for any Sum, Rate and Time. Having put the Parts, if there be any, into their Decimals; multiply the Principal and the Rate; from the Product cut off the due Decimal, if any, and two Places more for the Division by 100: This Product so ordered is the Interest due for one Year; which if you multiply by the Time

be it more or leſs than a Year) the Product (the due Decimal cut off) is the Intereſt for that Time.

Example 1. What is the Simple Intereſt of 132 *l.* 7 *s.* 6 *d.* for 2 *y.* 3 *m.* 22 *d.* at 6 *l.* in the Hundred?

The Decimal of 7 *s.* 6 *d.* is 375; which being annexed to the whole Pounds, the Principal will be 132 *l.* 375, which multiplied by 6, and the Product ordered as directed, it will be 7.9425, or 7 *l.* 18 *s.* 10 *d.* 1 *f.* Year, for the Intereſt for one Year. But that being not the Sum ſought, multiply the ſaid 7.9425 and the Time, *viz.* 2 *y.* 3103, the Product 18.3493 is the Intereſt ſought, *viz.* 18 *l.* 6 *s.* 11 *d.* 3 *f.*

Example 2. What is the Intereſt of the ſaid Sum for two Months and ten Days at the ſame Rate? Multiply the ſaid 7.9425 by .1941 the Decimal of the Time, the Product 1 *l.* 5416, or 1 *l.* 10 *s.* 10 *d.* is the Intereſt ſought.

But the great Convenience of Decimals, is, that their Logs. are ſo eaſily found; as is already ſhewn in this ſecond Section. So that by the *Tabulæ Logarithmicæ* mentioned in the forecited Place, any Queſtion, whoſe Numbers (whether whole, mixt, or Decimals) exceed not ſix Places, may be ſpeedily reſolved: Mr. *Townley*'s Indices of the Decimals freeing us from perplexity of different Rules. As in the two laſt Examples.

Example 1.

100. *Ar. Com.* 8.	
132.375.	2.1218052
6.	0.7781512
7.9425	0.8999571
2.3103	0.3636083
18.3495	1.2636254

Example 2.

100. *Ar. Com.* 8.	
132.375	2.1218059
6.	0.7781512
.1941	9.2880255
1.5416	0.1879826

To the Arith. Compl. of the Log. of 100, *viz.* 8.0000000 add the Log. of the Principal and of the Rate; the Sum is the Log. of the Intereſt for one Year. To which Log. if you add the Log. of the Time, this Sum ſhall be the Log. of the Intereſt for the Time.

Or without ſeeking the Intereſt for one Year: To the ſaid Ar. Compl. add the Logs. of the Principal, Rate, and Time, the Sum ſhall be the Log. of the Intereſt demanded, as in the ſecond Example.

3. Compound Intereſt for any Principal, Rate, and Time by the Logarithms.

In this Propoſition the Excellency of thoſe Numbers appear; ſuch Queſtions being reſolved by them with great Eaſe and Speed; but by natural Arithmetick not without conſiderable Time and Trouble.

Deduct the Log. of 100 from the Log. of 100, and the Rate added

added together, as 105, 106, &c. The Difference multiply by the Time: From the Product cut off the Decimal, if there be any: The Remainder add to the Logarithm of the Principal; the Sum is the Logarithm of the Principal and Interest required.

Example.

Let the Principal, Rate, and Time be as in the former of the two last Questions. Pursuing the Rule, as you see in the Margin; the Sum of the principal and compound Interest is 151 *l.* 9 *s.*

The Difference		2530
The Time		2.31
The Product		584639.89
	132.375	2.12180
		5846
	151.45	2.11026

It seems by this, that the Interest of 100 *l.* at 6 *l. per Ce*[nt.] by the Year, is not fully mounted to 3 *l.* in six Month[s]; for if you multiply the afores[aid] Difference by 5, the Decima[l] six Months; and, having cut one Place, add the Residue the Log. of 100, the Sum be 2.0126529; which is Log. of 102.956, that is 10 19 *s.* 1 *d.* 1 *f.*

I will add two or three [Ex]amples more, which, I ho[pe] will be sufficient.

1. What is the Value of 28 Ounces, six Penny Weights [and] 15 Grains of Gold, at 3 *l.* 3 *s.* 6 *d.* the Ounce? Annexing Decimals to the Integers, the Numbers stand thus:

	ou.	*l.*	*ou.*	*l.*
	1 :	3.175 : :	28.33125 :	89.952

	l.	*s.*	*d.*	*f.*		
					3.175	9.5017437
Facit,	89 .	19 :	00 .	2	28.33125	1.4522657
					89.952	1.9540094

2. If 4 . 9 . 12 (*ou. p. gr.*) of Gold cost 14 . 10 . 9 (*l. s. d.*); What is the Ounce?

The Numbers are 4.475 (*ou.*) : 14.51875 (*l.*) : : 1 (*ou.*) : 3.2444 (*l.*)

	l.	*s.*	*d.*	*f.*	4.475 *Ar. Compl.*	9.3492070
Facit,	3 .	04 .	10 .	2.	14.51875	1.1619291
					3.2444	.5111361

3. At 6*s.* 3*d.* the Ounce; how much Silver Plate will 5*l.* 3*s.* 6*d.* buy?

	l.		*ou.*		*l.*		*ou.*
The Numbers are	0.3125	:	1	: :	5.175	:	16.56

	ou.	*p.*	*gr.*			
				.3125	*Ar. Compl.*	0.50515
Facit,	16.	11.	05 near.	5.175		0.71391
				16.56		1.21909

I have taken but six Figures in this last Example. If I had used no more in the other, the Difference would have been little or inconsiderable; as you may find if you please to give your self that small Trouble.

TRILATERAL [in *Geometry*] three sided.

TRILLION [in *Arithmetick*] the Number of a Billion of Billions.

To TRIM [in *Carpentry*, &c.] a Term us'd for fitting one Piece into another, who then say, trim in a Piece.

TRIMMERS [in *Architecture*] Pieces of Timber that are fram'd at Right Angles to the Joints, against the ways for Chimneys and Well Holes for Stairs.

TRINE *Dimension*, or three-fold *Dimensions*, includes Length Breadth and Thickness. The *Trine Dimension* is peculiar to Bodies or Solids.

TRINGLE [in *Architecture*] a Name common to several little square Members or Ornaments, as *Reglets*, *Listels*, or *Plat-bands*.

TRINGLE is particularly us'd for a little Member fix'd exactly over every Triglyph, under the Plat-Band of the Architrave, from whence the *Guttæ* or Pendant Drops, hang down.

TRIPARTITION is a Division by three; or the taking the third Part of any Number or Quantity.

TRIPLE, *Three-fold.*

TRISECTION } [in *Geometry*]
TRISSECTION }
the dividing a Thing by three; it is chiefly us'd for the Division of an Angle.

The Trisection of an Angle Geometrically, is one of those great Problems, the Solution of which has been so much sought after by Mathematicians for 2000 Years; being in this respect on a Footing with the Quadrature of the Circle, and the duplicate of the Cube Angle.

Several late Authors have written on the *Trisection of a Triangle*; and pretend to have found out the Demonstration, but they have all committed Paralogisms.

TROCHILE } [in *Architecture*] is
TROCHILUS } that hollow Ring or Cavity, which runs round a Column, next to the *Tore*; or it is one whose Cavity is compos'd of two Arches.

TROCHLEA is one of the Mechanical Powers, and is what we usually call the Pulley.

TROCHOID [in *Geometry*] a Curve, whose Genesis may be thus conceiv'd. If a Wheel or Circle be mov'd with a two-fold Motion at the same time, the one in a Right-Line, and the other circularly about its Centre, and these two Motions be equal; *i. e.* describe two equal Lines in the same time: and if in the Radius; which at the beginning of the Motion reaches from the Centre of the Wheel, or the first Point of the Line, which describes the Circumference If, I say, in this Radius a Point be taken any where, except in the Centre, this Point will describe a Curve, one Part of which will be below the Line describ'd by the Centre, and the other above it; this Line thus describ'd by the Point taken in the Radius, is call'd the *Trochoid*.

The Right-Line which joins the two Extremities of the *Trochoid*, and which is either the Path the Wheel makes, or a Line parallel to that Path is call'd the Base of the *Trochoid*.

The Axis of the *Trochoid* is the Diameter of the Wheel, perpendicular to the Base in the middle of the Motion; or that Part of the Radius between the *Trochoid* and its Base.

The Point wherein the Axis is cut into two Parts by the Line describ'd by the Centre of the Wheel, is call'd the Centre of the *Trochoid*; the uppermost Point of the Axis, the Vertex of the *Trochoid*; and the Plane comprehended between the *Trochoid* and its Base, the *Trochoidal Space*.

The *Trochoid* is the same with what is otherwise call'd the *Cycloid*; the Properties, &c. of which you may see under the Article *Cycloid*.

TROPHY [in *Architecture*] is an Ornament which represents the Trunk of a Tree, charg'd or encompass'd all around about with Arms or military Weapons, both offensive and defensive.

TRUNCATED *Pyramid*, or *Cone*, is one whose Top or Vertex is cut off by a Plane parallel to its Base.

TRUNK [in *Architecture*] is us'd for the Fust or Shaft of a Column, with that Part of the Pedestal between the Base and the Cornice, call'd the Die.

TUBE, a *Pipe*, *Conduit* or *Canal*; being a Cylinder hollow within, either of Iron, Lead, Wood, &c. for the Air or some other Fluid to have a free Passage.

TUSCAN *Order* [in *Architecture*] is the first, simplest and most massive of the five Orders.

The *Tuscan* is call'd the *Rustic* Order by *Vitruvius*, and M. *de Chambray* agrees with him, who in his Parallel says it never ought to be us'd but in Country Houses and Palaces.

M. *L*

M. *Le Clerc* adds, that in the Manner *Vitruvius* and *Palladio*, and ſome others have ordered it, it does not deſerve to be us'd at all. But in *Vignola*'s Manner of Compoſition, he allows it a Beauty, even in its Simplicity; and ſuch as makes it proper, not only for private Houſes, but even for publick Buildings; as in the Piazza's of Squares and Markets; in the Magazines and Granaries of Cities, and even in the Offices and lower Apartments of Palaces.

The *Tuſcan* has its Character and Proportions, as well as the other Orders; but we have no ancient Monument, to give us any regular *Tuſcan* Order for a Standard.

M. *Perrault* obſerves, that the Characters of the *Tuſcan* are nearly the ſame with thoſe of the *Doric*; and adds, that the *Tuſcan* is in Effect no other than the *Doric*, made ſomewhat ſtronger, by ſhortening the Shaft of the Column; and more ſimple, by the ſmall Number and largeneſs of the Mouldings.

Vitruvius makes the whole Height of the Order 14 Modules, in which he is follow'd by *Vitruvius*, M. *Le Clerc*, &c. *Serlio* makes it but 12; *Palladio* gives us one *Tuſcan* Profile much the ſame as that of *Vitruvius*, and another too rich, on which Side *Scammozzi* is likewiſe too faulty.

Hence it is that that of *Vignola*, who has made the Order very regular, is moſt follow'd by modern Architects.

The *Tuſcan* is the moſt eaſily executed of all the Orders; in that it has neither Triglyphs, nor Dentils, nor Modillions to confine its Inter-columns.

On this Account, the Columns of this Order may be rang'd in any of the five Manners of *Vitruvius*, *viz.* the *Pycnoſtyle*, *Siſtyle*, *Euſtyle*, *Diaſtyle* and *Aræoſtyle*.

TUSCAN *Order, by Proportions of equal Parts.*

The Height of the *Pedeſtal* being two Diameters, is divided into 4, giving 1 to the Baſe, whoſe Plinth[a] is $\frac{2}{3}$ thereof, the other Part is divided into 3, giving 1 to the Fillet[b], and 2 to the Hollow[c]. The Breadth of the Die, or Naked, is one Diameter and $\frac{1}{3}$: and the *Projection* of the Baſe is equal to its Height. the Fillet hath $\frac{3}{4}$ thereof.

The Height of the *Cornice* is half the Baſe, being $\frac{1}{8}$ of the whole Height, and is divided into 8, giving 2 to the Hollow[d], 1 to the Fillet[e], and 5 to the Band[f]; the *Projection* is equal to the Baſe, and the Fillet hath three of theſe Parts.

Baſe of the Column: The Height is $\frac{1}{2}$ a Diameter, and is divided into ſix Parts, giving 3 to the Plinth[g], 2 and $\frac{1}{2}$ to the Torus[h], and $\frac{1}{2}$ a Part to the Fillet; the whole *Projection* is $\frac{1}{3}$ of its Height, and the Fillet equal to its Height. The Hollow or Cincture[i] is $\frac{1}{4}$ of a Circle in all the Orders, and belongs to the Shaft of the Column.

The *Diminishing* of this Column is $\frac{1}{4}$ of the Diameter.

The Height of the *Capital* is $\frac{1}{2}$ a Diameter, and is divided into 9, giving $2\frac{1}{2}$ to the Frieze[k] of the Capital, $\frac{1}{2}$ a Part to the Fillet, 3 to the Ovolo[l], and 3 to the Abacus[m]. The whole *Projection* is $\frac{1}{8}$ of the Diameter being perpendicular to the Body of the Column below, and the Fillet projects equal to its Height.

The *Collerino*[n] or Necking of all the Orders in general is one of those nine Parts in the Capital, and the Fillet half a Part; the *Projection* is 1 and $\frac{1}{4}$ of these Parts, and the Fillet equal to its Height.

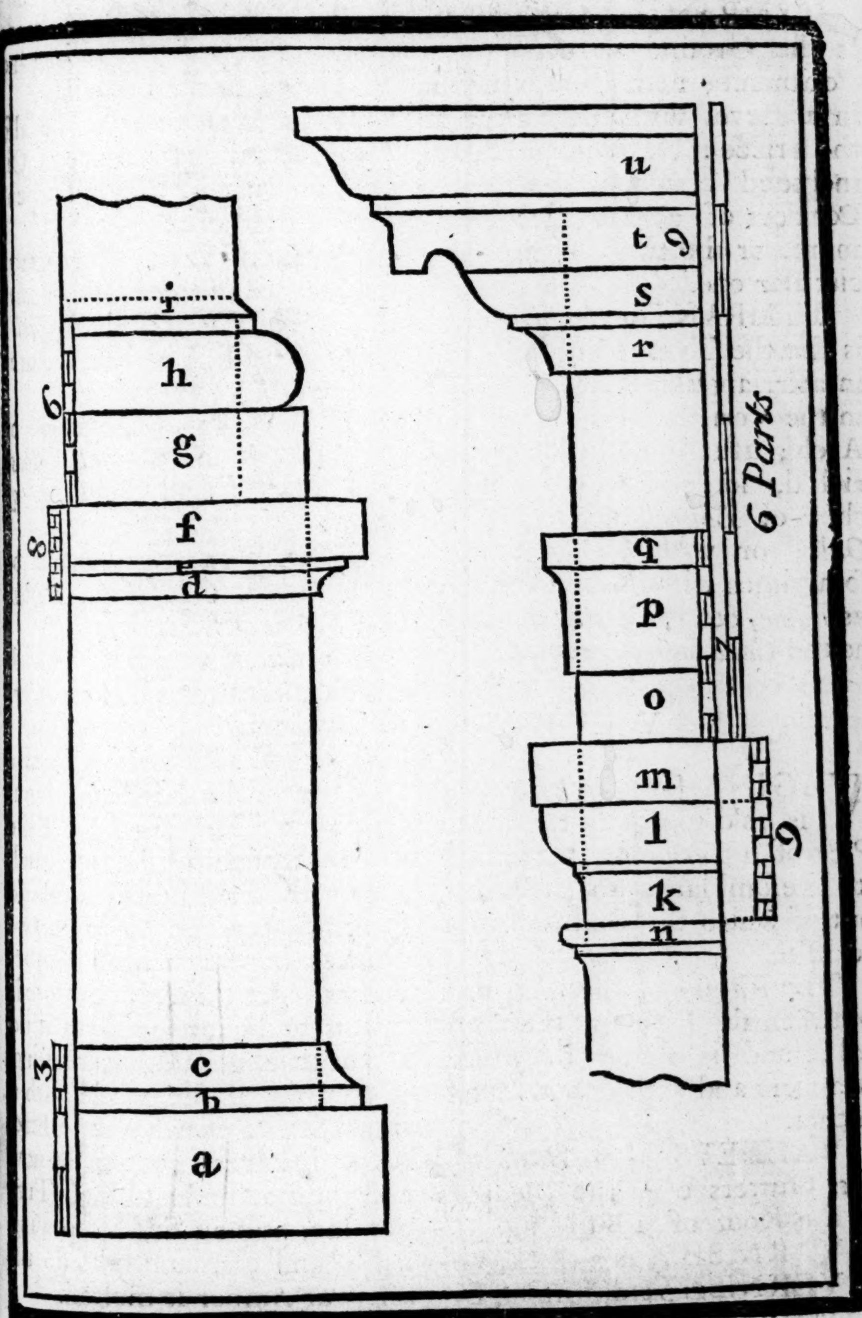
The Height of the *Entablature* being one Diameter and $\frac{3}{4}$, is divided into 6, giving 2 to the Architrave, 1 and $\frac{1}{2}$ to the Frize, and $2\frac{1}{2}$ to the Cornice.

For the Members of the *Architrave*, divide the Height into seven Parts, giving 2 and $\frac{1}{2}$ to the first Face[o], 3 and $\frac{1}{2}$ to the second[p], and 1 to the Band at Top[q]; the *Projection* is equal to the Band, and the second Face a third thereof.

N. B. The first Face of all the *Architraves* is perpendicular to the Naked of the Column at the Top.

For the *Cornice*, divide the Height into 9, giving 1 $\frac{1}{2}$ to the Hollow[r], $\frac{1}{2}$ a Part to the Fillet, 1 and $\frac{1}{2}$ to the Ovolo[s], 2 to the Corona[t], $\frac{1}{2}$ a Part to the Fillet, 2 to the Scima Recta[u], and 1 to the Fillet. For the *Projections*, the Hollow hath 2 of these Parts, the Ovolo 3 and $\frac{1}{2}$, the Corona 6, the Fillet 6 and $\frac{1}{2}$, and the Whole 9, being equal to the Height.

The Proportion of the TUSCAN *Order, by equal Parts.*



TUSK [in *Carpentry*] a Bevel Shoulder, made to ſtrengthvn the Tenon of the Joiſt, which is let into the Girder.

TYMPAN [in *Architecture*] is the Ground or Area of a Pediment; being that which is in a Level with the Naked of the Frieze: Or it is the Space included between the three Cornices of a triangular Pediment, or the two Cornices of a circular one.

TYMPAN [in *Architecture*] is alſo the Tympan of an Arch in a trriangular Space or Table in the Corners or Sides of the Arch; uſually hollow'd or enrich'd, ſometimes with Branches of *Laurel*, *Olive-Tree* or *Oak*; or with *Trophies*, &c. ſometimes with *Flying Figures*, as *Fame*, &c. or *Sitting Figures*, as the *Cardinal Vertues*, &c.

V

VAGINA [in *Architecture*] is us'd to ſignify the lower Part of a *Terminus*, becauſe of its Reſemblance to a Sheath, out of which the Statue ſeems to iſſue.

The *Vagina* is that long Part between the Baſe and the Capital; and is found in divers Manners and with divers Ornaments.

VALLEYS [in *Building*] the Gutters over the Sleepers in the Roof of a Building.

VARNISH } VERNISH } is a thick, viſcid, ſhining Liquor, us'd by Painters, Gilders, and various other Artificers, to give a Gloſs and Luſtre to their Works; as alſo to defend them from the Weath[er] Duſt, &c.

There are ſeveral kinds [of] Varniſhes in Uſe; as the *Si[c]cative* or *drying Varniſh*, mad[e] of Oil of *Aſpin*, *Turpentine* an[d] *Sandarack* melted together.]

White VARNISH, call'd al[ſo] *Venetian Varniſh*, made of O[il] of Turpentine, Fine Turpe[n]tine and Maſtic.

Spirit of Wine VARNISH made of *Sandarach*, *White Amber*, *Gum Elemi* and *Maſtick*: ſerving to gild Leather, Picture Frames, &c. withal.

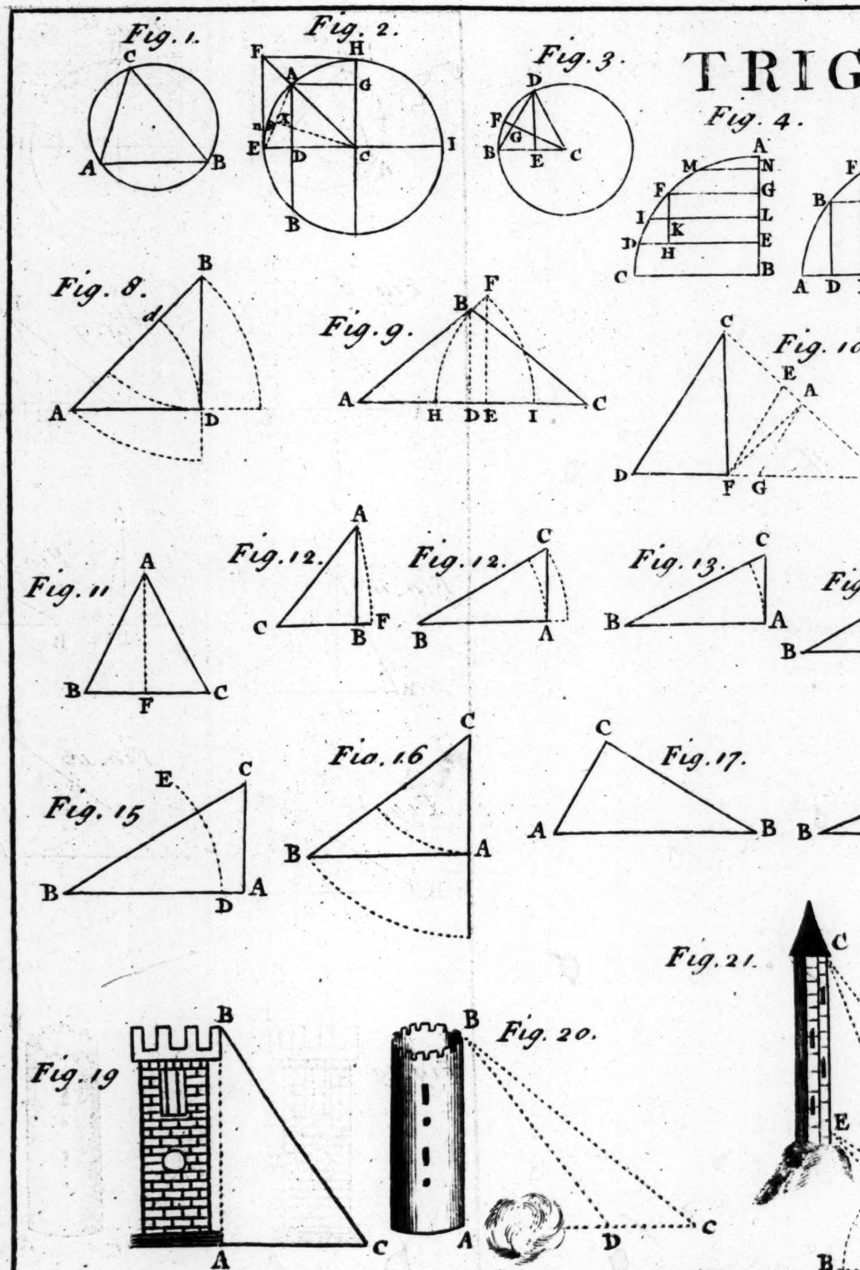
Gilt VARNISH, made o[f] *Linſeed Oil*, *Sandarach*, *Aloes*, *Gum Gutta*, and *Litharge* o[f] *Gold*.

China VARNISH, made o[f] *Gum Lacca*, *Colophony*, *Maſtic* and *Spirit of Wine*.

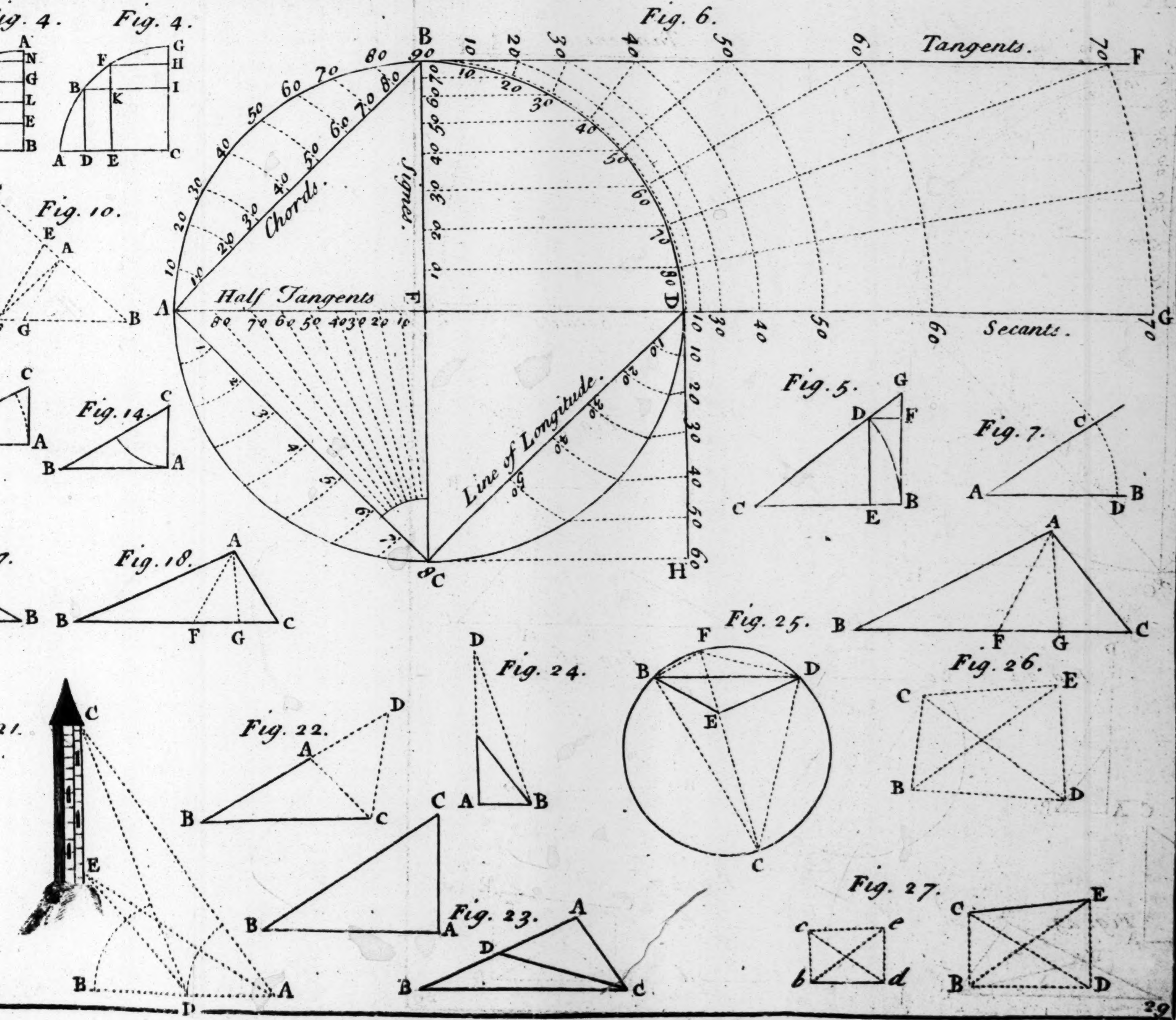
Common VARNISH, which is only common *Turpentine* diſſolv'd in *Oil of Turpentine*.

White VARNISH } *Amber* VARNISH } From [a] Manu[-]ſcript of Mr. *Boyle*. Tak[e] white Roſin four Drams, mel[t] it over the Fire in a clean glaz'[d] Pipkin, then put into it tw[o] Ounces of the whiteſt Amber you can get (finely powdered) this is to be put in by a little and a little, gradually, keeping it ſtirring all the while with [a] ſmall Stick, over a gentle Fire till it diſſolves, pouring in now and then a little Oil of Tu[r]pentine, as you find it growing ſtiff; and continue ſo to do til[l] all your Amber is melted.

But great Care muſt be taken not to ſet the Houſe on Fire for the very Vapours of the Oil of Turpentine will take Fire


TRIG
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 8.
Fig. 9.
Fig. 11
Fig. 12.
Fig. 12.
Fig. 13.
Fig. 15
Fig. 16
Fig. 17.
Fig. 19
Fig. 20.
Fig. 21.

RIGONOMETRY.



Fire by Heat only; but if it shall happen so to do, immediately put a flat Board or wet Blanket over the fiery Pot, and by keeping the Air from it, you will put it out, or suffocate it.

Therefore it will be best to melt the Rosin in a Glass of a Cylindric Figure in a Bed of hot Sand, after the Glass has been well *anneal'd* or warm'd by Degrees in the Sand, under which you must keep a gentle Fire.

When the Varnish has been thus made, pour it into a coarse Linnen Bag, and press it between two hot Boards of Oak or flat Plates of Iron; after which it may be us'd with any Colours in Painting, and also for varnishing them over when painted.

But for covering Gold, you must use the following Varnish: this is to be observ'd, that when you have varnish'd with white Varnish, you may put the Things varnish'd into a declining Oven, which will harden the Varnish.

A *Hard* VARNISH, *which will bear the Muffle (from a Manuscript af Mr.* Boyle'*s) for laying over any Metal, that appears like Gold, to prevent it from turning black, which all but Gold will be apt to do, when expos'd to the Air.*

Take of *Colophony*, which is to be had at the Druggists, an Ounce; set it over the Fire in a well glaz'd earthen Vessel, till it is melted; then by little and little, strew in two Ounces of Powder of *Amber*, keeping stirring it all the while with a Stick; and when you perceive it begin to harden or resist the Stick, then put in a little Turpentine Oil, which will thin and soften it immediately; then put in two Ounces of *Gum Copal* [finely powdered) sprinkling it in as you did the *Amber*, ever and anon pouring in a little Oil of Turpentine, and when it is done, strain it as before directed.

This is proper to varnish over Gold, and the Things done with it, must be set into a declining Oven, three or four Days successively, and then it will resist even the Fire.

A VARNISH *for Brass to make it look like Gold.*

This is us'd upon Leaf Gold, or upon that which is call'd *Dutch* or *German* Leaf-Gold, or upon Brass or Bath-Metal, which are design'd to imitate Gold.

Take two Quarts of *Spirit of Wine*, and put it into a Retort Glass; then add to it an Ounce of *Gamboge*, two Ounces of *Lake*, and two Ounces of *Gum Mastic*; set this in a Sand Heat for six Days, or else near a Fire, or you may put the Body of the Retort frequently into warm Water, and shake it two or three times a Day; then set it over a Pan of warm Small Coal Dust, before you lay this Varnish over the Metal, to be sure you see that it has been well clean'd, varnish it over thinly with this Varnish, and it will appear of the Colour of Gold. Set it in a

a declining Oven to harden, and it will not rub off.

N. B. This is a good Varnish to mix with any Colours that incline to red, and the white Varnish for mixing with those that are pale.

A VARNISH *for Wood, Paper,* &c.

The *Japanese* have a Method of making Plates, Bowls and other Vessels of brown Paper, and sometimes of fine Saw-Dust; which Vessels are very light, and very strong, which by Reason they are not liable to be broken by a Fall as *China* Ware or Porcelaine made of Earth, are much esteem'd with us. The Method of making them is as follows.

Take brown Paper, boil it in common Water, stirring and mashing it all the while with a Stick, till it is almost become a Paste; then take it out and pound it well in a Stone Mortar, till it is reduc'd to a soft pappy Consistence, like Rags for Paper making; then with common Water and Gum Arabic, a Quantity sufficient to cover this Paper Paste an Inch, put these together in a well glaz'd Pipkin, and boil them well, keeping continually stirring them, till the Paste is well impregnated with the Gum; then is your Paste fit for making any Form you design.

Having the Mould ready made, as suppose any Thing of the Figure of a Plate, you must have hard Wood turn'd on one Side of such a Figure, with a Hole or two in the mid dle, quite through the Woo to let any Water pass throug that is press'd out of the Paste which Mould must be concav and in the middle in the Form of the underside of a Plat also another Piece of har Wood must also be turne convex in the middle, and i the Form of the upperside a Plate; this must be about th eighth Part of an Inch less tha the under Mould; but abo the Rim or the Edge, you ma if you please, have some litt Ornament carv'd or engrav in the Wood.

These Moulds must be we oil'd on the turn'd Sides, as so as they are made, and mu be continued oiling, till th have been thoroughly drench with Oil, and oil them we again just before you use the to prevent the gummed Pa from sticking to the Wood; the under Mould upon a stro Table even, and spread it ov with some of your Paste as venly as you possibly can, as to be every where of an ev Thickness of about a quart of an Inch; then having oi the upper Mould, and put as exactly as may be on t Paste, and press it hard do setting a great Weight upon letting it remain in that St for 24 Hours.

When you suppose the Pa to be dry, take it out of t Moulds, and when it is th roughly dry, it will be as ha as Wood, and be fit to lay Ground upon, made with str Size and Lamp-black, lett

ry gently; and when that is
roughly dry, mix Ivory-
ck with the following Var-
h, and use it as hereafter
ected.

strong *Japan* VARNISH.

Take an Ounce of Colopho-
, and melt it in a well glaz'd
then Vessel; then having
ee Ounces of Amber finely
lveriz'd and sifted, put it in
little and little, adding now
d then some Spirit of Tur-
ntine: when it is thoroughly
elted, sprinkle in three Oun-
s of Sarcacolla, keeping it
the while stirring, putting
frequently more Spirit of
urpentine, till all is melted
d well incorporated; then
ain it through a coarse Hair
g, plac'd between two hot
ards, and press it gently, re-
iving the Clear into a well
z'd Pot, made warm; with
is Varnish mix the ground
ory-Black, and having first
arm'd the Vessel made in the
ould, whatsoever Form it is,
ate, Bowl, &c. lay it on be-
re the Fire in a warm Room,
at the Air may not chill the
arnish; lay it on equally and
en set it into a gentle Oven;
d the next Day into a hotter,
d the third Day into one that
very hot, letting it stand in
till the Oven is quite cold,
d then it will be fit for any
se, either for Liquors cold or
t, and will never change, nor
n they be broken but with
eat Difficulty.

As for the Moulds, it is pro-
ble they might do as well if they were cast of any hard Metal, as if turn'd of Wood.

You may also make what Things you please of fine Saw-dust, by drying it well, and pouring on it some Turpentine; having an equal Quantity of Rosin melted with it, and half the Quantity of Bees-wax, mix them well together, and put them to the dry Saw-dust, stirring all together till the Mixture becomes thick as a Paste; then take it off the Fire, and having warm'd your Moulds, spread some of the Mixture on the under Mould, that has a Hole in the Middle, as equally as possible, and press the upper Mould upon it, as before; let it stand to cool, and your Vessel will be fit for painting.

There may, if you please, be some *Sarcacolla* finely powder-ed; put into this while your Turpentine is melting, to the Quantity of half the Turpentine; stirring it well, and it will harden it: This Varnish will most safely be made in the open Air, because it will endanger the House, and have a wet Cloth ready to put it out, if it takes Fire.

But which ever of the Mixtures you use, if you have a mind to have them appear like Gold, do them over with Gold Size, and when that begins to stick a little, with the Finger, lay on Leaf Gold, either real Gold, or that which is brought from *Germany*; but the last is apt to change green, as most of the Preparation from Brass will do; such as those which are call'd Bath-metal, and others

thers of the like Sort, which appear like Gold, when they are fresh polish'd, or clean'd every Day; but as the Air coming upon them will make them alter to another Colour, Gold itself is rather to be chosen, which is durable, and will never change, and is also a much finer Colour than any of the former for a Continuance.

And altho' the Leaf Gold is tender, and may be supposed to be liable to rub off, yet the Varnish with which it is to be varnish'd over, will keep it bright and intire.

When the Leaf Gold has been laid on, and the flying Pieces brush'd off, which is not to be done till the Gold Size is dry, then varnish it over with the following Varnish.

VARNISH *for Gold, or such Leaf of Metals that imitate Gold.*

Take Colophony, and having melted it, put in two Ounces of Amber, finely powdered, and some Spirit of Turpentine, and as the Amber thickens, keep it well stirring; then put in an Ounce of Gum Elemi, well pulverised, and more Spirit of Turpentine, constantly stirring the Liquor till all is well mix'd and incorporated: But take care however to use as little Turpentine as you can; because the thicker the Varnish is made, the harder it will be. Let this be done over a Sand-Heat, in an open Glass, then strain it, as is directed for the preceeding Varnish. This Varnish is to be used alone; first

warming the Vessels made
Paper Paste, and lay it on w
a painting Brush before
Fire, but not too near, le
the Fire raise it into Bliste
After this has been done, h
den it three several Times
Ovens; first with a slack He
the next with a warmer, a
the third with a very hot on
and the Vessels will look li
polish'd Gold.

And as for such Vessels, &
as shall be made with Saw-d
and Gums; the Varnish m
be made of the same Ingred
ents as above-mentioned, exce
the Gum Elemi; and this w
dry in the Sun, or in a gen
Warmth.

To varnish of a Red Colour

After what you would va
nish has been prepared as b
fore, and are thoroughly d
mix Vermilion with the thi
Varnish, and use it warm; th
stove it, or harden it by Degre
in an Oven; and it will appe
very glossy, or else lay on yo
first Ground with Size and Ve
milion, and in proper Plac
you may stick on with Gu
Arabick, and water some F
gures cut out of Prints, as litt
Sprigs of Flowers, or such lik
and when they are dry, pai
them over with Gold Size, a
let that remain, till it is a litt
sticky to the Touch; then l
on your Gold, and let that
well clos'd to the Gold Siz
and dried. See the Article *Gil*
ing. Then if you would sha
any Part of your Flower, ta
some Ox-gall, and with a fi

Came

mels Hair Pencil, trace over shady Parts on the Leaf-ld, and with deep *Dutch* k; and when that is dry, uſe r Varniſh in a warm Place ean that Varniſh directed the Covering of Gold) and it to harden by degrees in Oven, which Varniſh will re the Leaf Gold; altho' be only that called *Dutch* ld, or Metal, from changing keeping the Air from it.

rniſhing any Thing which is vered with Leaf Silver.

irſt paint the Thing over h Size, and ground Chalk or iting; let them ſtand till y are thorougly dry, and n do them over with very d Gold Size, of a bright lour (for there is much Dif-ence in the Colour of it; ne being yellow, and others oſt white; the firſt is moſt per for Gold, and the laſt Silver). When this Size is oſt dry, that it will juſt k a little to the Touch, lay the Leaf Silver, and cloſe ell to the Size. See the ticle *Gilding*.

VARNISH *for covering Silver.*

Melt in a well glaz'd Pipkin, e fine Turpentine, and put three Ounces of white Am-, finely powdered (more or , according to the Quantity r Work will require) put in by little and little, keep-it continually ſtirring, ad-g by Degrees ſome Spirit of Turpentine, till all the Amber is diſſolved, and then add to it an Ounce of *Sarcacolla* well beaten, and an Ounce of Gum *Elemi* well levigated, adding now and then a little Spirit of Turpentine, till all is diſſolved: do this over a gentle Fire, and keep it conſtantly ſtirring.

This Varniſh will be white and ſtrong as the former, and is to be uſed warm, and hardened by degrees in an Oven, as varniſhed Gold, and it will look like poliſhed Silver.

VARNISH *for Wood, to mix with ſeveral Colours.*

Take Spirit of Turpentine, and diſſolve in it a little Gum *Taccamahacca* over the Fire, till it is a little thickened; and this may be uſed with any Colour, that has been well ground with Water, and afterwards reduced to a fine Powder. When the Work is done, you may, if you pleaſe, varniſh over your Piece, with the ſame Varniſh directed for Silver and Wood, Tables, Tea-Boards, or any Thing elſe, may be done in the ſame Manner, as is directed for Veſſels made of the Paſte of Paper and Saw-duſt.

Varniſhing Prints, &c. with white Varniſh ſo as to bear Water and Poliſhing.

The Print ſhould be firſt paſted either on Board or ſhock Cloth, ſtrained on a Frame; in order to do this well, prepare ſome ſtiff Starch; and with a Spunge dipt in Water, or thin

Starch

Starch (without any Blue in it) wet the Back of your Print, and if you design to lay it on a board, dip a large Brush in thick Starch, and brush it over the Board as even as possible, and let it dry (or you may lay a Ground of Whiting and Size on the Board first, which will do very well) then repeat it a second Time, and so continue till the Veins or Grain of the Wood is quite filled.

In the last Operation, when the Starch is just laid on, lay your wet Print upon it, as smooth as possible, that there be no Wrinkles, nor Bubbles in it, and press it on close every where, till it lies smooth, and so set it by to dry, which it will be, and fit to varnish in 24 Hours with the following Varnish.

Take *Ichyocolla*, or *Fish-glue*, or *Isinglass*, two Ounces, and after you have pulled it into small Pieces, boil it in a Pint of Brandy or strong Spirits in a well glaz'd earthen Vessel, till it comes to a strong Glue, which you may know by taking out a little, and exposing it to the Air; it is then fit for your Purpose; but don't fail to make it as strong as you can.

And while it is hot, with a large Brush, brush over the Print as quick as you can, and as smooth and even as may be, set it by for a Day or two, and then do it over again with the same Varnish or Glue, and let it dry again very well; then brush it over with white Varnish at such a Distance from the Fire, that it may not blister; repeat this two or three Tim then let it stand for a Day two, and then varnish it again with the white Var the third Time, with two three Passages of the Bru then let it stand for three four Days, and it will be h enough to be polished, wh is to be done with a soft Lin Cloth and some *Tripoli*, ru bing it very gently, till it is smooth as may be, and aft wards clear it with Flour a Oil; and then it will app as clear as Glass; and if at a Time it is sullied with F Shits, you may clean it, by wa ing it with a Spunge and W ter.

The white VARNISH.

Take Gum Sandarach of t clearest and whitest Sort, eig Ounces, Gum Mastick of t clearest Sort, half an Oun of *Sarcacolla* the whitest, thr Quarters of an Ounce, *Ven* Turpentine an Ounce and half, Benzoin the clearest o Quarter of an Ounce, whi Rosin one Quarter of an Ounc Gum *Animæ* three Quarters an Ounce. Let all these b dissolved, and mixt in the Ma ner following.

Put the *Sarcacolla* and R sin into a little more Spiri than will cover them to di solve; then add the Benzoi Gum *Animæ* and *Venice* Tu pentine, into either a Glass glaz'd earthen Vessel, and pou on as much Spirits as will c ver them an inch; then pu the Gum Mastick into a Gla

or glaz'd Veſſel, and pour ſtrong Spirits upon them, covering them alſo about an Inch thick, to diſſolve them rightly; then put your Gum *Elemi* in a diſtinct Veſſel as before, and cover it with Spirits to diſſolve.

For this Purpoſe, you need only break the Roſin a little, and powder the Gum *Animæ*, *Sarcacolla* and *Benzoin*.

Let all ſtand three or four Days to diſſolve, ſhaking the Glaſſes, *&c.* two or three times a Day, and afterwards put them all together into a glaz'd Veſſel, ſtirring them well, and ſtrain the Liquor and Gums gently; beginning with the Gums, through a Linnen Cloth.

Then put it into a Bottle, and let it ſtand a Week before you uſe it, and pour off as much of the clear only, as you think ſufficient for preſent Uſe.

To paſte Prints upon Cloth for Varniſhing.

If the Print be put upon a ſhock Cloth, well ſtrained in a Frame, bruſh the Cloth over with ſtrong Paſte, made with Flour and Water, and immediately bruſh over the back of the Print with well prepar'd Starch; and then bruſh the Cloth over with the ſame Starch, and lay on the Print as ſmooth as poſſible, without leaving any Wrinkles or Bubbles in the Paper. This you ſhould take Notice of, that when you have laid your Paper upon the Cloth, they will both together appear flagging, and unſtrained; but as ſoon as they are dry, all will be ſmooth, as either of them was at firſt.

Let them ſtand ſo in a dry warm Place for a Day or two, and then you may varniſh your Print as before directed, with Glue made of *Icthyocolla*, and then with the white Varniſh.

With this Varniſh you may mix up any Colour, that has been ground dry, with a Marble, and paint it upon any Figure you have drawn, or upon any Print you have paſted upon your Work; but the varniſhed Colours ſhould be chiefly put upon the ſhady.

VARNISH *made with Seed* Lacca.

Take a Pint of ſtrong Spirit of Wine, put into a Glaſs Veſſel, and put to it three Ounces of Seed *Lacca*, and let them ſtand together for two Days, ſhaking them often, then paſs it through a Jelly Bag, or a Flannel Bag, made like what is called *Hypocrates*'s Sleeve, letting the Liquor drop into a well glaz'd Veſſel, and giving the Gums a Squeeze every now and then; when the Varniſh is almoſt out of the Bag, add more, and preſs it gently till all is ſtrained, and the Dregs remain dry.

Be ſure you do not throw the Dregs into the Fire, for they will endanger ſetting the Houſe on Fire.

Put the Varniſh up in a Bottle, and keep it cloſe ſtopt, ſetting it by, till all the thick Parts are ſettled to the Bottom, which they will do in three or four

Day

Days, then pour off the clear into a fresh Bottle, and it will be fit for Use.

As for Varnish made of *Shell-Lacca*, it is not of any great Service, tho' so often recommended, for it will not bear the Polish.

When you lay on your Varnishes, take the following Method.

1. If you varnish Wood, let your Wood be very smooth, close grain'd, free from Grease, and rubb'd with Rushes.

2. Lay on your Colours as smooth as possible, and if the Varnish has any Blisters in it, take them off by a Polish with Rushes.

3. While you are varnishing, keep your Work warm, but not too hot.

4. In laying on your Varnish, begin in the Middle, and stroke the Brush to the Outside, then to another extreme Part, and so on till all be covered; for if you begin at the Edges, the Brush will leave Blots there, and make the Work unequal.

5. In fine Works use the finest *Tripoli* in polishing: do not polish it at one Time only; but after the first Time, let it dry for two or three Days, and polish it again for the last Time.

6. In the first polishing you must use a good deal of *Tripoli*; but in the next a very little will serve; when you have done, wash off your *Tripoli* with a Spunge and Water; dry the Varnish with a dry Linnen Rag, and clear the Work, if a white Ground, with Oil and Whiting; or if black, wi Oil and Lamp-Black.

An Useful VARNISH.

Take drying Linseed Oil, s it on the Fire, and dissolve it some good Rosin, or (whic is better, but dearer) Gun lacca; let the Quantity be suc as may make the Oil thick a Balsam. When the Rosin Gum is dissolved, you ma either work it off it self, or ad to it some Colour, as Verd grease, for a green; or Ambe for an Hair Colour; or Indi and White, for a light Blue.

This will secure Timbe work done over with it, equ to painting with Colours i Oil, and is much more easy obtain; for Linseed Oil an Rosin are more easily melte together, by boiling, than Co lours can any ways be ground and being of the Consistence a Balsam, works very readil with a Brush, and of it sel without the Addition of Co lours; bears a Body sufficien to secure all manner of Timbe Work, equal to most Oil Co lours.

In the working of it, there no great Skill required, if yo can but use a Painter's Brush only let the Matter you lay on, be thoroughly drenche that the Outside may be glaz' with it: And if you desire Colour on the Outside, you nee only grind a Colour with th last Varnish you lay on.

o preserve bright Iron-work from Rust, and other Injuries of a corroding Air, by an oily Varnish.

Take good *Venetian*, or for nt of that the best and clear- common Turpentine, dis-ve it in Oil of Turpentine, d add to it some Linseed Oil, de clear by long standing in hot Sun (for some uses the mon drying Linseed Oil y serve;) mix them well to-her, and with this Mixture nish over any Sort of bright n-work whatsoever.

lt is a certain Preserver of such Iron-work from Rust, it be what it will, provided be such as is not brought in-common Use, for much dling will wear it off, and at will dissolve it; but for such bright Iron-work that used about either Carpenters Joiners Work, that require much handling; as also ms, *&c.* that hang up for te, rather than present Use, is an infallible Preservative.

When you use this oily Var-h, 'tis best to warm it, and with a Brush lay it on as as possible; this is best for ms; but for other Iron-k, it may be laid on cold; four or five Days after it has laid on, it will be tho-ghly dry.

Note, That such Arms as e been done over with it, y when they come into use cleansed from it again, by g warmed hot before a Fire: Heat will dissolve it, but Water will do it no Hurt.

VASES [in *Architecture*] are certain Ornaments placed on Cornices, Socles or Pedestals; representing the Vessels of the Ancients; particularly those used in Sacrifices, as Incense Pots, Flower-Pots; all which are occasionally enrich'd with *Basso Relievo's*.

They are usually placed there to crown or finish Facades, or Frontispieces.

Vitruvius speaks of a Sort of Theatrical Vases made of Brass, or earthen Ware, which were disposed in private Places, under the Steps and Seats of the Theatres, to aid and increase the Reflection and Resonance of the Actors Voices, *&c.*

It is said there are of these Sort of Vases in the Cathedral Church of *Milan*.

VASE is particularly used in Architecture, to signify the Body of the *Corinthian* and Composite Capital, and is called the Tambour or Drum, and sometimes the *Campana*.

VAULT [in *Architecture*] is a Piece of Masonry-Arch without Side, and supported in the Air by the Artificial placing of the Stone which forms it, its principal Use being for a Cover or Shelter, or it is an arch'd Roof, so contriv'd, as that the several *Voussoirs* or Vault-Stones, of which it consists, do, by their Disposition sustain each other. Vaults are to be preferred on many Occasions to *Soffits* or flat Cielings, as they give a greater Rise and Elevation, and besides are more firm and durable.

Salmasius obſerves, that the Ancients had only three kinds of Vaults. The fiſt was the *Fornix* made Cradle-wiſe; the ſecond, a *Teſtudo*, i. e. *Tortoiſe-wiſe*, which the *French* call *Cul de Four* or *Oven-wiſe*; and the third, *Concha*, or Trumpet-wiſe.

But the Moderns have ſubdivided theſe three Sorts into many more, to which they have given different Names, according to their Figures and Uſes, ſome of them are circular and others eliptical.

Again, the Sweeps of ſome are larger, others leſs Portions of a Sphere. All ſuch as are above Hemiſpheres are called *High* or *ſurmounted Vaults*; and all that are leſs than Hemiſpheres, are called *Low* or *ſurbaſed Vaults*, or *Teſtudines*.

In ſome *Vaults* the Height is greater than the Diameter; in others, it is leſs: others again are quite flat, and only made with Haunſes, others like Ovens, or in the Form of a *Cul de Four*, &c. and others growing wider as they lengthen, like a Trumpet.

There are alſo *Gothick Vaults*, with *Ogives*, &c.

Of *Vaults* ſome again are *ſingle*, others *double*, *croſs*, *diagonal*, *horizontal*, *aſcending*, *deſcending*, *angular*, *oblique*, *pendent*, &c.

Maſter Vaults are thoſe that cover the principal Parts of Buildings, in contradiſtinction to the upper or ſubordinate *Vaults*, which only cover ſome little Part, as a Paſſage or Gate, &c.

A *double Vault* is one th[at] is built over another, [to] make the outer Decoratio[n] range with the inner, or [to] make the Beauty and Decora[-] tion of the Inſide, conſiſtent wi[th] that of the Outſide, leaves [a] Space between the Concavi[ty] of the one, and the Concavi[ty] of the other. Inſtances of whic[h] we have in the Dome at S[t.] *Peter*'s at *Rome*, St. *Pau[l's]* in *London*, and in that of th[e] Invalids at *Paris*.

Vaults, with Compartment[s] are ſuch whoſe Sweep, or inn[er] Face is enrich'd with Panne[ls] of Sculpture, ſeparated by Pla[t-] bands. Theſe Compartment[s] which are of different Figure[s] according to the Vaults, a[re] uſually gilt on a white Groun[d] are made with Stone or Bric[k] walls; as in the Church of S[t.] *Peter* at *Rome*, or with Plaiſt[er] on Timber Vaults.

Theory of Vaults.

A Semi-circular Arch [or] Vault, ſtanding on two Pi[e-] droits, or Impoſts, and all t[he] Stones that compoſe them, b[e-] ing cut, and placed in ſu[ch] Manner, as that their Joints [or] Beds being prolonged, do [all] meet in the Centre of t[he] Vault; it is evident, that [all] the Stones muſt be in the Fo[rm] of Wedges, *i. e.* muſt be wi[der] and bigger at Top, by virt[ue] of which they ſuſtain each [o-] ther, and mutually oppoſe t[he] Effort of their Weight, whi[ch] determines them to fall.

The Stone in the middle [of] the Vaults, which ſtands p[er-] pendicu[lar]

pendicular to the Horizon, and is called the *Key* of the Vault, is sustained one each Side by two contiguous Stones, just as by two inclin'd Planes; and consequently the Effort it makes to fall, is not equal to its Weight.

But still that Effort is the greater, as the inclin'd Planes are less inclin'd; so that if they were infinitely little inclin'd, *i. e.* if they were perpendicular to the Horizon, as well as the Key, it will tend to fall with its whole Weight, and would actually fall, but for the Mortar.

The second Stone, which is on the right or left of the *Key-Stone*, is sustained by a third, which by virtue of the Figure of the Vault, is necessarily more inclined to the second, than the second is to the first; and consequently the second, in the Effort it makes to fall, employs a less Part of its Weight than the first.

For the same Reason, all the Stones from the *Key-Stone*, employ still a less and less Part of their Weight to the last; which resting on a horizontal Plane, employs no Part of its Weight; or which is the same Thing, makes no Effort at all, as being intirely supported by the Impost.

Now in *Vaults*, a great Point to be aimed at, is, that all the *Voussoirs* or Stones make an equal Effort towards falling: To effect this, it is visible, that as such (reckoning from the Key to the Impost) employ still a less and less Part of its whole Weight; the first, for Instance only employing one half, the second, one third, the third one fourth, &c. There is no other way of making those different Parts equal, but by a proportionable Augmentation of the whole, *i. e.* the second Stone must be heavier than the first, the third than the second, &c. to the last; which should be infinitely heavier.

M. *de la Hire* demonstrates what that Proportion is, in which the Weights of the Stones of a Semi-circular Arch must be increased to be *in Equilibrio*, or to tend with equal Forces to fall, which is the firmest Disposition a Vault can have.

The Architects before him had no certain Rule to conduct themselves by, but did all at Random. Reckoning the Degrees of the Quadrant of a Circle, from the Key-stone to the Impost, the Extremity of each Stone will take up so much the greater Arch, as it is farther from the Key.

M. *de la Hire*'s Rule is to augment the Weight of each Stone above that of the Key-stone, as much as the Tangent of the Arch of half the Key.

Now the Tangent of the last Stone of Necessity becomes infinite, and of consequence its Weight should be so too; but as Infinity has no Place in Practices, the Rule amounts to this, that the last Stones be loaded as much as possible, that they may the better resist the Effort which the Vault makes to separate them; which is call'd the Shoot or Drift of the Vault.

Mr. *Parent* has since determined the Curve or Figure, which the *Extrados* or Outside of a Vault, whose *Intrados* or Inside is spherical, must have that all the Stones may be *in Equilibrio*. See *Bridges*.

The Key of a Vault is a Stone or Brick in the middle of the Vault, in Form of a truncated Cone; which serves to bind or fasten all the rest.

The Reins of a Vault, or the filling up are the Sides which sustain it.

The Pendentive of a Vault is the Part suspended between the Arches or *Ogives*.

The Impost of a Vault is the Stone on which the first *Voussoir* or Stone of the Vault is laid.

VELOCITY [in *Mechanicks*] *i. e.* Swiftness, is that Affection of Motion, whereby a Moveable is disposed to run over a certain Space in a certain Time.

The greatest Velocity wherewith a Ball can descend, by virtue of its specifick Weight, in a resisting Medium, is that which the same Ball would acquire by falling in an unresisting Medium thro' a Space, which is to be four Thirds of its Diameter, as the Density of the Ball to the Density of the Fluid.

Huygens, *Leibnitz*, *Bernouli*, and other foreign Mathematicians, hold, that the *Momenta*, or Forces of falling Bodies, at the End of their Falls, are as the Squares of their Velocities into the Quantities of Matter. On the contrary, the *English* Mathematicians maintain them to be as the Velocities them-selves into the Quantities of Matter. Velocity is conceive[d] to be either absolute or rela-tive: The Velocity which ha[s] been already considered i[s] simple or absolute, in respec[t] to a certain Space, mov'd i[n] a certain Time.

Relative or respective Velo-city, is that wherewith tw[o] distant Bodies approach eac[h] other, and come to meet in [a] longer or less Time; whethe[r] only one of them moves to-wards the other at rest, o[r] whether they both move; whic[h] may happen two ways, eithe[r] by two Bodies mutually ap-proaching each other in th[e] same right Line, or by tw[o] Bodies moving the same Wa[y] in the same Line, only th[e] foremost slower than the other for by this means this will over-take that, and as they come t[o] meet in a greater or less Tim[e] the relative Velocity is greate[r] or less.

Thus if two Bodies com[e] nearer each other by two Fee[t] in one second of Time; thei[r] respective Velocity is doubl[e] that of two others, which onl[y] approach one Foot in the sam[e] Time.

VENEERING } is a Sor[t]
VANEERING } of Marque-try, or inlaid Work, whereb[y] several thin Slices, or Leaves o[f] fine Woods of different Kind[s] are applied and fastened on [a] Ground of some commo[n] Wood.

There are two kinds of in-laying; the one which is th[e] more ordinary, goes no farthe[r]

tha[n]

than the making Compartments of different Woods; the other requires a great deal more Art, and represents Flowers, Birds, and the like.

The first kind is what we properly call Veneering, the latter is described under the Article Marquetry.

The Wood intended for Veneering is first sawed out into thin Slices or Leaves, about a Line thick; in order to saw them, the Blocks or Planks are placed upright, in a kind of Sawing Press.

These Slices are afterwards cut into narrow Slips, and fashioned divers ways, according to the Design proposed: After this the Joints are carefully adjusted, and the Pieces brought down to their proper Thickness, with several Plans for that Purpose; then they are glued down on a Ground or Block of dry Wood, with good strong *English* Glue.

The Pieces being thus jointed and glued, the Work, if small, is put into a Press; if large, it is laid on a Bench covered with a Board, and press'd down with Poles or Pieces of Wood, one End of which reaches to the Cieling of the Room, and the other bears on the Board.

When the Glue is thoroughly dry, they take it out of the Press and finish it; first with little Planes, afterwards with divers Scrapers; some of which resemble Rasps which take off the Dents, &c. left by the Planes.

When the Work has been sufficiently scraped, it is polished with the Skin of a Sea-dog, Wax and a Brush, and a Polisher of Shave-grass; which is the last Operation.

VENTIDUCTS [in *Building*] ar Spiracles or subterraneous Places, where fresh cool Winds being kept, are made to communicate, by means of Ducts, Funnels, or Vaults, with the Chambers or other Apartments of an House, to cool them in sultry Weather. These are called by the *Italians*, *Ventidetti*, and by the *French*, *Prisons des Vents*, and *Palais d'Eole*.

VERDEGREASE is the best and most useful green of all others; this Colour is made out of Copper, being no other than the Rust of that Metal, promoted by the Fumes of sour Wine, and the Rape of Grapes; the Process of which, as it is perform'd at *Montpelier*, in *France* (where the best is said to be made) as may be seen in Mr. *Ray*'s Travels, *pag.* 454. It is a delicate Green inclining to a bluish; but with a little Pink-yellow, makes the delicatest Grass-green in the World, It is a Colour that will grind very fine; but not without some Pains; and when ground fine, it lies with a good Body, and works well.

They have at the Colour-shops a Sort of it, that they call distill'd Verdegrease, being that which is perfectly purified from Dross and Filth, of good Use in fine Work, but too dear for common Painting.

Green VERDITER is a ſandy Colour, and does not bear a good Body, and is ſeldom uſed but in Landskip, where Variety is required. It ſhould be waſhed before uſed. See waſhing of *Colours*.

Blue VERDITER is ſomething ſandy, of no very good Colour, of it ſelf, nor no good Body, being apt to turn greeniſh; but being mix'd with yellow, makes a good green. It ought to be waſhed before uſed. See waſhing of *Colours*.

VERMILION is the moſt delicate of all light Reds, being of it ſelf a perfect Scarlet Colour; it is made artificially out of Quick-ſilver and Brimſtone, in the manner following.

Take ſix Ounces of Brimſtone, and melt it in an Iron Ladle, then put two Pound of Quick-ſilver into a ſhammy Leather, or double Linnen Cloth, and ſqueeze it out into the melted Brimſtone, ſtirring them, in the mean Time, with a wooden *Spatula* till they are well united; and when they are cold, beat the Maſs into a Powder, and ſublime it in a Glaſs-veſſel, with a ſtrong Fire, and it will riſe into that Red Subſtance, which is called artificial Cinnabar or Vermilion. The whole Proceſs may be ſeen more at large in *Lemery*'s Chymiſtry.

This Colour is of a delicate fine Body, and if Pains be beſtowed on it, it will grind as fine as the Oil it ſelf, and then it makes a moſt excellent Colour: But if it be not ground very fine, the Glory of it wi not appear; for it will loo dull, and work coarſe; but it be ground very fine, no C lour in the World looks bett or works ſmoother, nor bears better Body than Vermili does, nor goes farther.

VERTEX the Top of a Thing, as the Vertex of a Co Pyramid, Conick Section, &

VERTEX [of a Glaſs Opticks] is the ſame with t Pole of the Glaſs.

VESTIBLE [in *Archite ture*] a kind of Entrance in large Buildings; being an op Place before the Hall, or at t Bottom of the Stair-Caſe.

VESTIBLES only intend for Magnificence, are uſual between the Court and the Ga den: Theſe are ſometim *ſimple*, *i. e.* have their opp ſite Sides equally enrich'd wi Arches; and ſometimes th Plan is not contained under fo equal Lines, or a circular o but forms ſeveral *Van Cor* and *Rear Corps*, furniſhed wi Pilaſtets, *&c.*

The *Romans* had Places c led Veſtibles, at the Entra of their Houſes, for the Shel of thoſe Perſons who were liged to ſtand at the Door. A we have now Veſtibles of the li Kind in many old Church Houſes, *&c.* called *Porches*.

Martinius derives the W from *Veſtæ ſtabulum*, by rea that the Fore-part of the Ho was dedicated to *Veſta*, and thers ſay, becauſe it was u for People to ſtop in the V tible before they went in Do

Daviler derives it from *Ves-*, a Garment, and *ambu-re*, to walk, because the *Ves-ble* in the modern Houses be-g an open Place at the Bot-m of a large Stair-case, serv-g as a Thorough-fare to the veral Parts of the house; re they first let fall their rains in Visits of Ceremony. Vestible is also sometimes sed to signify a little kind of ntichamber before the En-ance of an ordinary Apart-ent.

VIBRATION [in *Mechan-ks*] is a regular, reciprocal otion of a Body, *e. gr.* of a endulum; which being sus-nded at Freedom, swings or brates first this Way, and then hat.

For the Bob being raised, lls again by its Gravity, and ith the Velocity thus acquir'd, ses to the same Height on the ther Side; from whence its ravity makes it fall again; d thus its Vibrations are con-inued.

Mechanical Authors, instead f Vibration, frequently use the erm *Oscillation*.

The Vibrations of the same endulum are all *Isochronal*, *e.* they are performed in qual Time, at least in the me Climate; for towards the quator they are somewhat ower.

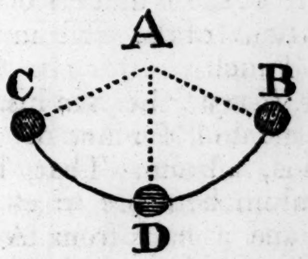
A Pendulum three Foot hree Inches, and two Tenths f an Inch, according to *Huy-ens*, or 39.25 Inches, accord-g to Sir *John Moor* and Lord *rouncker*, vibrates Seconds, r makes 3600 *Vibrations* in an Hour.

The *Vibrations* of a longer Pendulum take up more Time than those of a shorter one, in a sub-duple *Ratio* of the Lengths.

Thus a Pendulum three Foot long, will make 10 *Vibrations*, while another nine Inches long, makes 20: for 10 is the half of 20, and three Feet, or 36 Inches, are the Square of six Inches, which is the double of three, whose Square is nine: So that 10 is to 20 in a sub-duple *Ratio* of 36 to 9.

The same is meant, when we say, that the Number of *Vibrations* of *Pendulums* in a given Time, is in a reciprocal *Ratio* of their Lengths.

VIBRATION is the circular Motion of a Body, as B or C swinging on a Line, &c. fastened at A as a Center, which Point A is called the Center of Motion, and by some, the Center of reciprocal Motion; the Point D is called the Point of Rest, and a Line A B is called the Pendulum.



A is called the Center of reciprocal Motion, because when the Pendulum A D is moved from the Point of Rest D to C, it moves about that Point A to return to D, first on the one Side, and then on the other, until by its own Gravity, it

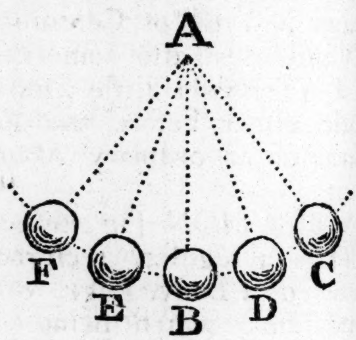
ceaſes its Motion, and remains in D the Point of Reſt : wherefore 'tis called the Center of reciprocal Motion.

Vibration is either *ſimple* or *compound* ; that is *ſimple*, when the Pendulum has moved from B to C, and *compound* when it has returned back again from C to B, *&c.*

Pendulums of equal Lengths and Weights, perform their Vibrations very near in the ſame Time ; but *Pendulums* of different Lengths will vibrate unequally, becauſe a longer *Pendulum* muſt remove more Air in its Swing or Vibration than a ſhorter.

It has been found by ſeveral Experiments, that the Length of two unequal Pendulums are reciprocally proportionable to the Squares of the Numbers of their Vibrations ; that is the Length of the firſt Pendulum : is to that of the ſecond : : as the Square of the Numbers of the Vibrations of the ſecond : in a given Time : is to the Square of the Numbers of the Vibrations of the firſt in the ſame Time.

Mr. *Henry Philips* in his Advancement of the Art of Navigation, affirms, That if a Pendulum be made = 38 Inches and a half from A the Center of Motion, to C the Center of Gravity of a Bullet, *&c.* every Vibration of ſuch a Pendulum will be = one Second or both Parts of a Minute of Time : that is every Time that the Body C or D paſſes by the Point of Reſt B, either from B to C, and back again to B, or by the Point of Reſt B, either from B to C, and back again to B, or from B to F, and back again to B, will be = one Second of Time, and conſequently its Motion from C to B, or from B to F, *&c.* muſt be = half a Second of Time.



Here it is to be obſerved, that it is no Matter what Swing or Diſtance from the Point of Reſt you firſt give it ; for the Body will vibrate in the ſame Time from C to F, as from D to E.

Therefore if ſeveral Pendulums of equal Lengths and Weights were ſet going together at the ſame Time, with Difference, at firſt they would be all in perpendicular Poſition as A B at the ſame Time.

For tho' the Body C, being raiſed higher from B than the Body D, will vibrate with greater Velocity than the Body D, which is raiſed but half the Height of C. Yet if both Sides are ſet going at the ſame Time, they will paſs by the Point of Reſt at the ſame Time, their Velocity being proportionable to the Spaces through which they paſs,

Th

This is plain; for as the Body D vibrates but to E, which is but half the Arch C F, thro' which the Body C vibrates at the same Time: therefore the Body D requires but half the Velocity of the Body C, *&c.*

VICE [in *Smithery*, &c.] is a Machine or Instrument serving to hold fast the Pieces to be filed, bent, riveted, *&c.*

The Parts of the Vice are the Plane, which is its uppermost Part; the Chaps which are cut with Bastard Cut, and well tempered; the Screw-pin, cut with a square strong Worm; the Nut or Screw-box, which has a square Worm, and is braz'd into the round Box, the Spring which throws the Box open, and the Foot on which the whole is mounted.

VICE [with Glaziers] a Machine for turning or drawing Lead into flat Rods, with Groves on each Side, to receive the Edges of the Glass.

VISION [in *Opticks*] the Laws of Vision brought under Mathematical Demonstration, make the Subject of Opticks taken in the greatest Latitude of that Word: for among the Writers of Mathematicks, Opticks is most generally taken in a more restrained Signification for the Doctrine of direct Vision; Catoptricks for the Doctrine of reflected Vision; and Dioptricks for that of refracted Vision.

Direct VISION } is that Simple VISION } which is performed by means of direct Rays; that is of Rays passing directly, or in right Lines, from the radiating Point to the Eye.

Reflected VISION is that which is performed by Rays reflected from *Specula* or Mirrours.

Refracted VISION is that which is performed by Means of Rays refracted or turned out of their Way, by passing thro' Mediums of different Density, chiefly thro' Glasses and Lenses.

VISUAL RAYS are Lines of Light imagined to come from the Object to the Eye.

VISUAL Point [in *Perspective*] is a Point in the horizontal Line, wherein the ocular Rays unite. Thus a Person who stands in a straight long Gallery, and looking forwards, the Sides, Floor and Cieling seem to meet, and touch one another in a Point or common Center.

VIVO [in *Architecture*] the Shaft or Fust of a Column; it is also used for the naked of a Column.

UMBER is a Colour of great Use in vulgar Painting; it is an Earth or Mineral dug out of a certain Island in the Mediteranean Sea, being of the Complexion of that which among us is called a Hair Colour; it grinds very fine, and bears the best Body of any earthy Colour, now in use, and when burnt, becomes the most natural Shadow for Gold of all others, and with a Mixture of white, it resembles the Colour of new Oaken Wainscot; it dries quickly and with a good Gloss.

Umber if it be intended for the Colour of a Horſe, or a Shadow for Gold, then burning fits it for that Purpoſe, by making it darker.

It muſt only be put into the naked Fire in large Lumps, and not taken out till they be thoroughly red hot, or you may, if you pleaſe incloſe it in a Crucible, and then put it into the Fire till it be red hot, and then take it out, and when cold lay it by for Uſe.

UNDER PINNING [in *Building*] ſignifies the bringing it up with Stone under the Groundſells. Sometimes it is uſed to ſignify the Work itſelf when it is done.

[*The Price of doing it.*] The Price in ſeveral Parts of *Suſſex* (for the Workmanſhip only) in ſome Parts of *Kent*, is 1 *d.* ½ *per* ſuperficial Foot, and in *Suſſex* 1 *d. per* Foot.

In ſome Places, 'tis the Cuſtom in meaſuring it, to take in half the Shell into their Meaſure.

UNGULA [in *Geometry*] is the Section of a Cylinder cut off by a Plane, paſſing obliquely through the Plane of the Baſe, and Part of the Cylindrical Surface.

VOLUTE [in *Architecture*] is a Sort of Scroll or Spiral Contortion uſed in the *Ionick* and compoſite Capitals, of which it is the principal Character, and Ornament.

It is by ſome called the *Ram's-horn*, from the Reſemblance of the Figure thereto.

Moſt Architects are of the Opinion, that it was deſigned by the Ancients, to repreſen the Bark or Rind of a Tre laid under the *Abacus*, and twiſted thin at each Extrem where it is at Liberty: other ſuppoſe it to be a Sort of a Pillow or Bolſter laid between the *Abacus* and *Echinus*, to prevent the latter from being broke by the Weight of the former, and the Entablature over it, and accordingly call it *Pulvinus*. Others, after *Vitruvius*, ſuppoſe it to repreſent the Curls or Treſſes of a Womans Hair.

There are alſo eight angular Volutes in the *Corinthian* Capital, accompanied with eight other ſmaller ones, called *Helices*.

There are ſeveral Diverſities in the *Volute*.

In ſome the Liſt or Edge is in the ſame Line or Plane throughout all the Circumvolutions: ſuch are the antique *Ionick* Volutes, and thoſe of *Vignola*.

In others, the Spires or Circumvolutions fall back, and in others they project or ſtand out.

Again, in ſome, the Circumvolutions are oval: in others, the Canal of one Circumvolution is detached from the Liſt of another, by a Vacuity or Aperture.

In others the Round is parallel to the *Abacus*, and ſprings out from behind the Flower of it.

In others it ſeems to ſpring out of the *Vaſe* from behind the *Ovum*, and riſes to the *Abacus*, as in moſt of the fine compoſite Capitals.

Conſoles, *Modillions*, and other

[oth]er Sorts of Ornaments, have [l]ikewise their *Volutes.*

The *Volute* is a Part of great [i]mportance to the Beauty of [t]he Column. Hence Architects [h]ave invented divers Ways of [d]elineating it.

The Principal are that of *[V]itruvius*, which was long lost; [a]nd restored by *Gouldman*; and that of *Palladio. Daviler* prefers the former as the easier.

VOUSSOIR [in *Architecture*] a Vault-stone, or a Stone proper to form the Sweep of an Arch, being cut somewhat in manner of a truncated Cone, whose Sides, if they were prolong'd, would terminate in a Center, to which all the Stones of the Vault are directed.

VOUSSOIRS. See the Article *Bridges.* Also see the *Plate.*

The Figures 1 and 2, represent the Voussoirs of an Arch, and their Names, *viz.*

1. Is the Coussinet, or prime Voussoir, which is the first Stone of an Arch, from whence the Rise of the Center commences.

2. 2. 2, *&c.* The Voussoirs from the Head of a Bridge, and Haunses of a Vault or Arch.

3. The Key-stone, upon which, usually, are carved the Arms of him to whom the Bridge belongs, or who caused it to be erected.

A B C, the *Extrados.*

6, 8, 9, The *Extrados* and *Douelle, i. e.* the interior Surface of a Stone, or facing of an Arch, and Part of the Curve within one Voussoir; which in the Arch of a Bridge is sometimes also called the *Intrados.*

5, 6, The Bed of the *Douelle.*

6 and 1, The Joint of the Face or the Head.

5 and 6, The Joint of the *Douelle.*

A, 2, 8, The Height of the Retombe, which is the Position of every Stone in the Voussoir, which is laid upon the first, and is called the Coussinet of an Arch, which thence begins to form its Rise, and which being laid by themselves can subsist without a Center.

Figure 2. Represents the Empalement [*i. e.* the greatest Thickness of a Foundation of Piles] of a Foundation, from its Commencement, to which, at LH is given one fourth of the Height L M, when the Bottom L D is of a sufficient Consistence; and on the contrary, when the Bottom is doubtful, it is given one Third, or the half of L I of the Height of L M, with the Retraites.

C E proportional to the largeness of the Empalement.

The larger the Arches are of a Bridge that is projected, the larger must be the Piers and Abutments, and also the Voussoirs must be enlarg'd in Proportion.

We have indeed no certain Rule for determinig the Size of the Voussoirs of Arches, we can only take our Models from those Works which have been done, and especially of the most experienc'd antient Architects, and thence to frame a Rule for the proportioning the principal Materials, on which

consists

consists almost the whole Force of Arches and their Arrangement.

I have says M. *Gautier* observ'd the Works of the *Romans*, the Extrados Voussoirs being four Feet from the Tail to the Arches, which had ten Toises in the Opening, and that the same Voussoirs had in Length in the Bed, four Foot and a half, and 15 Inches in Thickness at the hollowed or concave Part of the Inside of a Voussoir; and that the Thickness from the Arch to the Key might be five Foot.

Upon this Foot may be fram'd a Rule of Proportion for all Sorts of Semi-circular Arches; so that if one follows the Rule of the antique Arch of *Pont du Gard*; we shall find that if an Opening of ten Toises of an Arch give four Feet for the Tail of a Voussoir; that five Toises will give but two Foot; and 15 Toises, six Feet; 20 Toises, eight Feet, and in fine, 25 Toises, 10 Feet.

But I would not follow the same Proportion in Arches of five Toises below; because this would reduce the Voussoir of an Arch of one Toise, opening to six Inches in the Tail, instead of one Foot and a half, which it ought to have.

So that if we compare a Voussoir of one Foot and a half in the Tail, for an Arch of one Toise wide, with one of two Foot in the Tail for an Arch of five Toises wide, the Rule will be better followed and better proportion'd in Respect to the Force or Strength of the Materials and their Bearing.

It is certain that a large Bridge that bears a large Carriage, is less loaded than a small Bridge that bears the same Carriage. Therefore in the last the Voussoirs ought to be proportioned to the Weight of the Carriages that pass over them, and not to the Materials with which they are built, which they ought to support. and which are not very heavy.

If the Weight of Carriages were diminish'd in Proportion to the largeness of the Bridges over which they pass, the first Rule of Proportion might be observ'd; but as it is augmented in Proportion to what is done in smaller Arches, the Voussoirs ought to be made proportional to the Weight they are to support, and not to those of large Arches, where the same Weight is but one Point in Respect to their Solidity and Mass.

It is also certain that Materials of more or less Consistence, will contribute more or less to the Solidity of these Works; that Voussoirs of three Foot in the Tail that are compact and close, will render an Arch of ten Toises opening more secure, than those of four Feet, which shall be of less Consistence; by Reason of their being made of more tender or soft Stone; and from *Physicks* it is that this Knowledge is to be gained, I am of Opinion says M. *Gautier*, that if these kinds of Proportions were followed, we should not fall into those

those Errors which are every Day commiited by those who are well acquainted with this Work.

I ſhall give an Example of a Bridge, which Decency hinders me from naming.

The Arch fell down; it was 12 Toiſes in the Aperture, and the Vouſſoirs, altho' the Stones were very tender, had beſides this, the Fault of having too little Tail to retain them; not at all proportion'd to the Rule aforeſaid.

As it is only the Vouſſoirs that keep the Work together, and the Maſonry that is ordinary above them, is laid on the Level, according to the Courſes of the Facades of the Bridges, it is certain that theſe Courſes do nothing but over-burden the Vouſſoirs, and that the Surpluſſage of Maſonry, is only proper for the compleating the Breaking of the Arch, and not for the Eaſing it.

I was call'd to give my Advice upon the falling of this Arch, I found that the Cut of thoſe Stones in Reſpect to the Scheme Arch Centre, was well perform'd, nevertheleſs the Work was exclaim'd againſt as defficient in that Point. But in the End I aſſur'd them, that to re-eſtabliſh this Bridge, the Bounding Vouſſoirs ought to have a greater Length than they had made them, and that they ought to be of Stone of a ſtronger Conſiſtence; and the Work being perform'd after this Manner, ſucceeded perfectly well.

It is certain (adds he) that *Paris* furniſhes the moſt accompliſh'd Architects in *Europe*; the Precautions that have been taken at the *Pont Royal* of the *Thuilleries*, in the Poſition of the Vouſſoirs whoſe Tails are without End, and which have been prolonged ſince the Falling of the Arches, mounting up towards the Key, as one may ſay to the Cordon or Plinth, and as far as to the Superficies of the Pavement, or above all, there is nothing but Vouſſoir *en Coupe*, according to the *Epure* of the Arches, ſeen at the Head for about a third Part of the Arch, all over the Place where the greateſt Effort is made.

Theſe Vouſſoirs *en Coupe* are lengthened at the End of their Tails, following the ſame Cut.

It is not becauſe the Vouſſoir is intire, that it ſecures the Work the better; it is its Length and its bearing on the Reins of the Arch which bind it and keep it in Place; when Bridges are not extradoſſed, and the Cut is adjuſted to perfect the whole.

A Vouſſoir may be eaſily prolonged, provided its Cut be follow'd in its prolongation, and there be no Void between them; and they may be ſecur'd by Cramping Irons, if you pleaſe.

My Advice, (ſays M. *Gautier*) is to lay them all dry, the one againſt the other in Courſes, after the Manner of the Ancients, and not to lay them in fine Mortar, but by the Abbreuvement ſtrained and put in.

In the fine Works of the Ancients we ſee that the greateſt

Part

Part of the Vaults, Arches and Arcades, and Arches built with large Blocks of hewn Stone; they neither us'd Mortar nor Cramp-Irons, and that all there was dry; they did not uſe Mortar in any but Vaults and Arches made of Shards, rough or unhewn Stones: The Mortar does not faſten and aſſure the Work but in the uniting of ſmall Materials and large Blocks of Stone, are ſuperior to the Feebleneſs of Mortar; the large Vouſſoirs of Bridges are not ſuſtain'd and ſecur'd, nor the Work, but by their own proper Weight join'd to the Cut, which prevents them from diſuniting; and this very ſame Weight, which is moſt often the Cauſe of the Ruin of the largeſt Buildings, is in Bridges the only Cauſe that ſecures them, and without which one cannot ſucceed.

It is not at all ſurprizing if the *French* Companions Stone-Cutters having penetrated beyond *Egypt*, the whole Length of the *Nile*, beyond ſome of their Cataracts and frightful Water-Falls, and having made a Stone-Bridge in one of the Places of this River, very narrow between two Rocks; they were eſteem'd as Demi-Gods.

The People of theſe Countries, very ignorant, but very docile, mock'd at the Enterprize of the *French*, but the Work being finiſh'd, they came from the Parts round about to croſs the *Nile* on this Work, not being able to comprehend that Stones thus ſet in Order, the one againſt the other, could be born up, and even as it wer hang in the Air. In Reality is the Cut of the Stones that the Soul of all the Vaults an of all the Stone-Bridges, an ought to be look'd upon a the principal Foundation o their Conſtruction.

There are Bridges made a of Brick; they do in ſome o them, for Neatneſs, Securit and Decoration, make *Arrete* and *Encoignures* of hew Stone.

That of *Thoulouſe* ma ſerve for an Example. Th Bricks are laid equally in Cu to the hewn Stone, making i follow the Tract of the [Epure] Plinth or Faſcia, that has bee trac'd. This they take Car on, that they be well burnt and the Mortar good and fine and that they may be aſſur'd o the Lime, to the End that i may ſoon lay hold.

There are alſo ſeen at *Montauban* and at ſeveral other Cities of *Languedoc*, Bridge made all of Brick, Houſes, Churches, Steeples and othe magnificent Works made o Brick.

The firſt Works of the earlieſt Ages were made of Brick, the *Jews* taken Captives; afte they had loſt their Liberty, were employ'd in Brick-making.

In Bridges either of Brick-work or Maſonry, the Materials ought to be expos'd to the Air and Rain for the Space of a Year; that is to ſay, one Winter and one Summer; and all at the End of that Tim ought to be rejected, either Brick or Stone, that have no

under-

undergone the Proof of the Heat of the Summer, and the Frost of the Winter; and the Inspectors of Works ought to cause them all to pass in Review the one after the other; and immediately break off the the Corners of all those that are not Proof.

Too great Precautions can't be taken in Works of such Consequence, which very often can't be remedied when once done.

The greatest Works of the first Men were built with nothing but Brick: the Tower of *Babel* and the Walls of *Babylon* were built only with Brick; and the Bricks are found as sound as they were the first Day they were laid there: For Mortar they us'd nothing but *Spaltum*, a Sort of Bitumen which they brought from a neighbouring Lake, and as some say, they mix'd Straw with it between the Joints of the Bricks to make a binding, which yet is seen intire, if with a Hammer a Piece of Brick is broken off with the Cement, if we believe what those who have travelled to those Parts have related.

When the Arches of one and the same Bridge have been larger the one than the other, and yet the Keys of the same Height; they have not brought them upon a Level, but in establishing the first Rises of the biggest Arches in the Piers below those of the smallest in Proportion to their Size.

They always also made their Arches Semi-circular, and rather than to sink them by Ellipsises, they rather chose to use one Portion of a great Arc, as has been observ'd of the *Pont du Gard*.

The *Goths* who succeeded to the good Gust of the *Roman* Architecture, made Bridges in many Parts of *France*, with *Gothic* Arches, *i. e.* of the *Third Point*, as certainly pretending by that to make less Push; both in their publick Buildings and Bridges, we see in many Places, and also in private ones; and also in those Churches which we see that were built in their Time. These *Gothic* Arches rise most in Bridges.

The Moderns on the Contrary by a Change and Novelty, common to all Ages, have fallen into Elliptical Arches; in Order to diminish the Ramp of Bridges, and by that Means to facilitate the Ascent of heavy laden Carriages.

One time or other, Change in these Things will come, when they will put on another Mode, according to the Humour of those Times.

Men begin to admire Scheme Arches, and yet Plat-Bands more; in fine, all that is the most compos'd where Nature is the most forc'd, or in which there is the most Labour, or the Art of which is the most surprizing, is what is at this time most in Fashion.

Of these three Manners of Arches, it may be said that that which is of the *Third Point* or *Gothic*, is capable of bearing a greater Load than a Semi-circular Arch; and a Semi-

Semi-circular than a Scheme Arch or an Elliptical one; the first is the most elevated or highest; the second is lower, and the last is the most Rampant and lowest.

Both the one and the other augment or diminish their Pushes in Proportion to their Disposition, and of Consequence they are differently us'd.

I have given upon the one and the other a Dissertation, which proves and demonstrates their Efforts more or less, to determine the Thickness of the Abutments which must sustain or keep them in, and the Piers which are to support them.

Thus far M. *Gautier*. See the Article *Bridges*.

UPRIGHT [in *Architecture*] is a Representation or Draught of the Front of a Building, call'd also an *Elevation*.

URN [in *Architecture*] a kind of Vase of a roundish Form, but biggest in the middle like the common Pitchers; now seldom us'd but as Ornaments, over Chimney-Pieces, Buffets, &c. or by way of Acroter's, a Top of Buildings, Funeral Monuments, &c. or

Serving as a Crowning over Ballustrades, and as an Attribute to Rivers, River-Gods, &c. in the Grotto's and Fountains in Gardens.

A Funeral Urn is a kind of cover'd Vase, enrich'd with Sculpture, and serving as the Crowning or finishing of a Tomb, a Column, a Pyramid, or other Funeral Monument, made in Imitation of the Ancients, who deposited the Ashes of their deceas'd Friends in this kind of Urn.

W.

WAINSCOT [in *Joinery*] is the Timber Work that serves to line the Walls of a Room, being usually in Pannels, and painted to serve instead of Hangings.

Even in Halls, 'tis usual to have Wainscot Breast high, by Reason of the natural Humidity of Walls.

Some Joiners put Charcoal behind the Pannels of the *Wainscot*, to prevent the sweating of the Stone and Brick-walls from unglueing the Joints of the Pannels; others use Wool for the same Purpose; but neither the one nor the other is sufficient in some Houses: the only sure way is to prime over the Back-Sides of the Joints with *White-Lead*, *Spanish-Brown* and *Linseed-Oil*.

The Price of Wainscotting is various. The Wainscotting with *Norway Oak*, the Workmen finding Stuff, is valued at 6 *s.* or 7 *s. per* Yard Square: The Workmanship only is about 2 *s.* in *London*: in *Rutland* 3 *s.* 6 *d.* or 4 *s. per* Yard, and Mr. *Wing* says five, if the Mouldings be large.

Plain Square Wainscotting] The Workman finding *Deal*, is valued at 3 *s.* and 3 *s.* 6 *d. per* Yard. For Workmanship only 1 *s. per* Yard.

Ordinary Bisection Wainscotting (the Workman finding *Deal*) is worth in *London* 3 *s.* 6 *d. per* Yard;

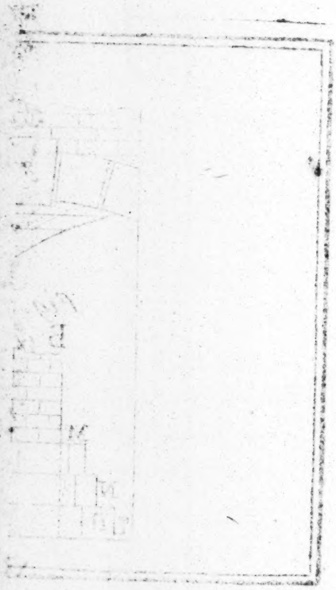
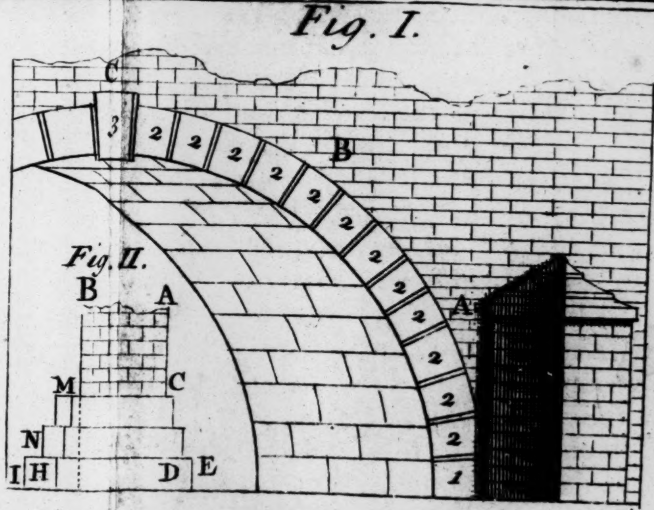


Plate XXX



...ard: in the Country 4 s. and ...s. 6 d. The Workmanship ...ly 1 s. and 1 s. 6 d. *per* Yard. Large Bisection *Wainscot-ing*, with *Dantzick* Stuff is ...lued at six or seven Shillings ...r Yard.

Of *Measuring Wainscotting*. ...ainscot is generally measured ...the Yard square, *i. e.* nine ...perficial Feet. Their Cus-...m is to take the Dimensions ...th a String, pressing it into ...e Mouldings; for they say, ...nd it is reasonable to be be-...ev'd) we ought to be paid for all ...here the Plane goes. There-...re when Joiners would take the ...imensions of a Room, they ...k up a Line on the Top of ...e Corner of the Room, and as ...ey carry it down to the Bot-...m, they press it with their ...ngers into all the Mouldings; ...is they account the Breadth, ...d they measure the Circum-...rence of the Room from the ...ength.

Some Joiners will measure ...s also with a String, but o-...ers do not.

The Dimensions being thus ...ken in the Feet, they multi-...y the Length by the Breadth, ...d the Product is the Content ...Feet, which being divided ...9, the Quotient is the Con-...t in Yards.

But you are to note, 1st, That ...ductions are to be made for ...Window-Lights, and that ...e Window-Boards, Cheeks ...d Soffeta's are to be measur-...by themselves.

2. That they reckon work ...d a half for *Window-shutters*, ...ors, and such Things as are wrought one both Sides; and indeed the Work is Half more.

3. That sometimes *Cornices*, *Bases* and *Sub-bases* are measured by the Foot lineal Measure; and so likewise are *Freezes*, *Architraves*, and *Chimney-pieces* measured, unless agreed for by the great.

WALLS [in *Architecture*, &c.] a Work of *Brick*, *Stone*, *Wood*, or the like, which make the principal Part of a Building, as serving both to enclose it, or separate particular Rooms, and to support the Roof, Floors, *&c.*

Walls are either intire or continual, or intermitted, and the Intermissions are either Pillars, or Pillasters.

Walls tho' built very thick and strong, and their Foundations laid deep, yet if carried on in a strait Line, are inclin'd to lean or fall; and such as are built crooked, tho' thin and weak, are much more lasting.

A *Wall* raised over a River on Arches of Pillars, will stand as firm as others whose Foundation is entire.

Hence it appears, that a Wall built much thinner than usual, by only having at every 20 Foot's Distance, an Angle, set out at about two Foot or more in Proportion to the Height of the Wall; or by having a Column at the like Distance erected along with it, six or eight Inches on each Side, and above the Thickness of the rest of the Wall: Such a Wall will be much stronger than if five Times the Quantity of Mate-

rials

rials were uſed in a great Wall.

Walls are diſtinguiſhed into divers kinds from the Matter of which they conſiſt. As,

Plaiſtered or *Mud-Walls*, *Brick-Walls*, *Stone-Walls*, *Flint* or *Boulder-Walls*, and *Boarded-Walls*. In all which theſe general Rules are to be regarded.

1. That they be built exactly perpendicular to the Ground-work; for the right Angle therein depending, is the true Cauſe of all *Stability*, both in artificial and natural Poſition; a Man likewiſe ſtanding firmeſt when he ſtands the moſt upright.

2. That the maſſieſt and heavieſt Materials be the loweſt, as fitter to bear, than to be born.

3. That the Walls as they riſe, diminiſh proportionably in Thickneſs, for Eaſe both of Weight and Expences.

4. That certain Burſes or Ledges, of more Strength than the reſt, be interlaid like Bones, to ſtrengthen the whole Fabrick.

Plaiſtered or *Mud-Walls*. Theſe kind of Walls are common in Timber Buildings, eſpecially ordinary Buildings; for ſometimes the Walls are made of Brick between the Timber. But this Way is not approved of, becauſe the Mortar corrodes and decays the Timber. Theſe Mud-walls (as they are called in ſome Places) are thus made.

The Walls being quartered, and lath'd between the Timber (or ſometimes lathed ove[r] all) are plaiſtered with Lime[,] which being almoſt dry, [i]s plaiſtered over again with whit[e] Mortar.

This Sort of Work is com[-]monly done by the Yard. F[or] the Price of it, ſee *Pargettin[g]* and *Plaiſtering*.

Brick-Walls, which are th[e] moſt important and uſual a[-]mong us; therefore to the fou[r] Rules before mentioned, theſ[e] are to be added.

1. Particular Care is to b[e] taken about laying of the Brick[s,] *viz.* that in Summer they b[e] laid as wet, and in Winter [as] dry as poſſible, to make the[m] bind the better with the Mo[r-]tar: That in Summer, as fa[st] as they are laid they be cover[ed] up, to prevent the Mortar, &[c.] from drying too faſt; that [in] Winter they be covered well [to] protect them from Rain, Sn[ow] and Froſt, which are all En[e-]mies to Mortar; that they [be] laid point and joint in the Wa[ll] as little as may be, but t[hat] good Bond be made there [as] well as on the Outſide.

2. That the Angles be fir[m-]ly bound, which are the Ner[ves] of the whole Edifice, and the[re-]fore are commonly fortified [by] the *Italians*, even in their Bri[ck] Buildings, on each Side of [the] Corners, with well ſqua[red] Stone, yielding both Stren[gth] and Grace.

3. In order to which, in wo[rk-]ing up the Walls of a Build[ing,] it is not adviſeable to raiſe [a] Wall above eight Foot hi[gh] before the next adjoining W[all] be wrought up to it, that

od Bond may be made in the rogress of the Work: For it an ill Custom among some ricklayers, to carry or work a whole Story of the Party alls before they work up the ronts, or other Work adjoin- g, that should be bonded, or rought up together with them; hich occasions Cracks and ttlings in the Walls.

4. That if you build a House the City of *London*, you ke all your Walls of such icknesses as the Act of Par- ment for re-building the said y enjoins; which Act you y see in the Article *House*; in other Places you may your Discretion. Yet for e Directions in this Matter, to the Article *House*.

. It may be worth your No- , that a Wall a Brick and f thick, with the Joint, will in Thickness 14 Inches, or y near; whence 150 or 160 ks will lay a Yard square, sured upon the Face of the lding, and to the Square of Foot (which is 100 Foot re Feet) are usually allow- 1700 or 1800 Bricks, and or 5000 Bricks will com- ly lay, erect or build, one , Pole or Perch square; h Rod, Pole or Perch; (for ll these Names it is called) ins in Length (according e Statute 16 ½ Feet, whose re is 272 ¼ Feet, superfi- Measure, which is 30 Yards ¼.

t tho' I have given the ber of Bricks for each of Squares; yet these Num- re not to be relied on as absolutely exact; for no Exact- ness can be discovered as to this Particular, and that for several Reasons.

For notwithstanding that all the Bricks be made in the same Mould, and burnt in the same Kiln or Clamp; yet the Na- ture or Quality of the Earth of which they are made (which causes some to shrink more than others) and the Brick- layers Hand and Mortar, may cause a considerable Variation.

And besides these, some Bricks are warp'd in Burning, (which makes them that they will not lie so close in the Work) some are broken in the Carriage; so that 500 Bricks and the Tally or Tale is, for the most Part (if not look'd af- ter) too little.

And besides all these Uncer- tainties, when Bricks are dear, and Lime cheap, the Work- man by the great, will use more Mortar, and make the larger Joints, which is much worse for the Building.

6. It may be also noted, that (when all Materials are ready) a Workman with his Labourer, will lay, in one Day, 1000 Bricks, and some 12 or 1500.

7. All Brick Work, according to these Rules, is supposed to be one Brick and half thick, which is the Standard Thick- ness. If they are thicker or thinner, they must be reduced to that Thickness.

Of Measuring Brick Walls.

Bricklayers most commonly measure their Walls by the Rod

ſquare, each Rod (which is by the Statute 16 ½ Foot;) ſo that a Square contains 272 ¼ ſuperficial Feet.

Therefore when they have taken the Dimenſions (*viz.* the Length and Height) of the Wall in Feet, they multiply the Length by the Height, by croſs Multiplication, and divide the Product by 272 ½, and the Quotient ſhews the Number of ſquare Rods in the Superficies of that Wall.

But it being troubleſome to divide by 272 ¼, Workmen have a Cuſtom to divide by 272 only, which gives the Contents ſomething more than the Truth, which notwithſtanding they take for it.

When they have then found the Area, or Contents of the whole Superficies of a Wall, they in the next Place conſider its Thickneſs; for they have a certain Thickneſs to which they reduce all their Walls, and this Standard is *one Brick and a half thick*, as they phraſe it, (*i. e.* the Length of one Brick, and the Breadth of another; ſo that a Wall of three Bricks (Length) thick, of the ſame Height and Length with another of one and a half Brick thick, the former will contain twice as many ſquare Rods as the latter.

Now to reduce any Wall to this Standard Thickneſs, take this Rule, which is plain and eaſy.

Say, as three is to the Thickneſs of the Wall in half Bricks, that is in the Breadth of the Bricks, the Breadth of a Brick being always half its Lengt ſo is the Area before found the Area at their Standa Thickneſs of 1 ½ Brick.

Thus if a Wall be all of o Thickneſs from the Found tion to the Top, it is eaſily duced to the Standard Thi neſs of 1 ½ Brick.

But if the Wall be of dif rent Thickneſſes (as they uſu ly are in Brick Houſes, be made thickeſt below, and th ner at every Story) then best Way will be to meaſ every different Thickneſs b ſelf, and to reduce it to Standard Thickneſs, and aft wards add all theſe ſeve Areas into one Sum, out which deduct the Doors Windows (meaſured by the ſelves) and then the Rema der will be the true Area Content of the whole Wallin

Note, That in ſome Pla 'tis the Cuſtom to meaſure the Rod of 18 Feet long, an others by the Rod of 16 F In the former Caſe, the A in Feet muſt be divided 324, and in the latter by 2

As to the Price.] The P of building Walls is variou different Places, according the various Prices of Mater

Mr. *Leybourn* ſays, that uſual Price in *London* for bu ing a Brick and a half W the Workman finding all M rials, is 5 *l.* or 5 *l.* 10 *s.* Rod ſquare, and for the W manſhip only 30 *s. per* ſquare, which is about 1 s Yard ſquare.

Mr. *Wing* ſays, That uſual Price in *Rutland*,

W

orkman finding all Materials) for a Brick and a half, 3 *s.* Yard square, (which is but out 4 *l.* 10 *s. per* Rod) for a o Brick Wall 4 *s.* and for a o and a half Brick Wall 5 *s.* Yard square.

And for the Workmanship ly (of a Brick and a half all) 8 *d. per* Yard square, hich is but about 20 *s. per* d, Statute Measure.

In *Sussex* a Rod of Brick and lf Walls, Workmanship and aterials, will cost at least 8 *l.* r the Workmanship only, the ual Price is 24 or 25 *s. per* d square, in a Brick and half ll.

Mr. *Leybourn* says, That in about *London*, if the Bricks laid in at the Builder's arge, then 2 *l.* 10 *s. per* d, is the usual Price.

But he says likewise, for e-ting new Structures, by ing down old Walls, it may worth 3 *l.* or 3 *l.* 10 *s. per* d; because in taking down Walls, there is much Time nt. And also more Mortar d in laying them again, than the new Work.

Fence Walls are Walls built nd Courts, Gardens and Or-rds, &c. which are commonly led *Fence Walls*; of which e are made of Stone, some Flints, or Boulders, and e of Brick.

. *As to those made with ick.*] These are commonly e (of Statute Bricks) a k and a half thick.

n some Parts of *Sussex* they made of a Sort of great ks, which are 12 Inches long, 6 Inches broad, and 3 Inches thick.

These Walls are but the Breadth of a Brick, or six Inches in Thickness, only at the Pilasters, where they are the Length of a Brick, or 12 Inches.

They usually set a Pilaster at every 10 Foot. Some of these Walls have stood well for 30 Years, and were in good Condition.

Of the measuring of them.] Fence Walls built of Statute Bricks, are commonly measured as the other.

But some measure them by the Rod in Length, and one Foot in Height, which they account a Rod in Measure; and in taking the Dimensions, they do it with a Line going over the Pilasters: this for the Length. So also for the Height, they measure that by the Line going over all the Mouldings (after the same Manner that Joyners measure their Work) even to the Top or Middle of the Copeing.

Some Workmen in making Fence Walls of Statute Bricks (if they can persuade their Masters to agree to it) measure all that is above a Brick and half thick (*viz.* the projecting of the Pilasters or Buttresses, and all below the Water-Table, by the solid Foot, which they afterwards reduce to Rods.

This Way is a considerable Advantage to the Workman, and a Loss to the Master-Builder; for it makes one sixth Part more of Measure than the Truth; because a Brick and half Wall is 14 Inches thick.

Fence Walls of great Bricks are generally meaſured by the Rod in Length, and a Foot in Height, which they account a Rod in Meaſure, the Dimenſions being taken by a Line, as has been ſaid above.

Of the Price.] Some Workmen in *Suſſex* reckon for building Fence Walls (for Workmanſhip only) of Statute Bricks, a Brick and half thick, 1 *s.* 6 *d.* *per* Rod, at a Rod long, and a Foot high, taking their Dimenſions by the Line, according as has been ſhewn.

Sometimes they build theſe Walls by the Square of 100 Foot at 8 *s. per* Square, which is but about 1 *d. per* ſuperficial Foot.

For building Fence Walls with great Bricks, the common Price (for Workmanſhip only) is 1 *s. per* Rod, at one Rod long, and one Foot high, the Dimenſions being taken by the Line, as above.

Of Copeing them.] Fence Walls, built with Statute Bricks, are ſometimes cop'd with Stone, ſometimes with Brick. If they are cop'd with Stone, the Copeing is left out of the Meaſure, and rated by itſelf; for the Price of which, ſee *Copeing.* If they are coped with Brick, it is meaſured into the reſt of the Work.

And this Sort of Copeing is performed as follows. The Wall is carried up to the Top on one Side, and on the other Side there is two Courſes of Bricks, ſtanding on end, in an oblique reclining or ſlant Poſition, and a ſtretching Courſe on the Top finiſhes the Wall.

But Fence Walls built of great Bricks are coped wit[h] copeing Bricks; of which, ſe[e] *Bricks.* And this Copeing [is] alſo meaſured and rated wit[h] the reſt of the Wall.

Of Stone Walls.

Stone Walls ſerve not onl[y] for Walls of Houſes, &c. bu[t] alſo for Fence Walls round Gardens, &c.

Of meaſuring them.] The[y] are in ſome Places meaſured b[y] the Rod of 18 Foot Square but in moſt Places they a[re] meaſured by the ſuperfici[al] Foot.

There are three Things [to] be obſerved in meaſuring [of] them.

1. That if the Length of t[he] Walls at the Ends of the Ga[r]den or Houſe, be taken on t[he] Outſide of the Garden or Hou[ſe] then the Length of the Walls [on] the Sides of the Garden [or] Houſe, ought to be taken [on] the Inſide.

2. That when the Walls of [a] Houſe are meaſured, the Do[ors] and Windows are likewiſe to [be] meaſured and deducted fro[m] the whole.

3. That in meaſureing Fen[ce] Walls, they commonly meaſu[re] the Height by a Line (preſſ[ed] into all the Moulding) from t[he] Top of the Copeing to the Bo[t]tom of the Foundation.

As to their Price.] M[r.] *Wing* ſays, That Fence Wa[lls] of ordinary Buildings, are ea[ch] (only the Workmanſhip) fro[m] 16

16 s. to 3 l. 10 s. *per* Rod, of 18 Feet square, which, he says, depends upon the Goodness of the Work.

He also says, that setting Fronts in great Buildings, *viz.* *Ashlar*, *Architrave*, *Windows* and *Doors*, with Ground-table *Fascias*, and other Members, is worth from 3 l. 10 s. to 5 l. *per* Rod, which, he says, depends upon the Height and well performing the Building.

But what he says, is not very intelligible; for 3 l. 10 s. *per* Rod, is but a little above 2 d. ½ *per* Foot; and 5 l. *per* Rod, but little more than 3 d. ½ *per* Foot; either of which is certainly too little for such ornamental Work, as setting off of Fronts in great Buildings. Neither does he mention any Thing of the Thickness of the Walls.

And then as for Fence-walls, or Walls in ordinary Buildings, it does not appear how the Goodness or Badness of such plain Work, can vary the Price from 16 s. to 3 l. 10 s. *per* Rod.

Mr. *Hatton* talks much after the same Manner, when he says, that one Foot of plain Work (as Walls, &c.) is worth about 8 d. working and setting. Nor does he mention any Thing of the thickness.

But these Authors having left us in the dark, I shall leave them, and inform you what is more intelligible, and what a *Sussex* experienc'd Workman says of the Matter: That for Building a 12 Inch Wall they have 2 d. *per* Foot; for an 18 Inch Wall, 3 d. that for a Wall of two Foot thick, they have 4 d. *per* Foot.

These Prices are to be understood of Walls which have two fair Sides; for if they have but one fair Side (the other standing against a Bank) they have a less Price. And in this Case some Workmen have built a Wall for 2 d. ½ *per* Foot.

Flint or Boulder Walls.

These Walls are much used in some Parts of *Sussex* and *Kent*, both for Fence Walls, round Courts, Gardens, &c. but also Walls of Stables and other Out-houses, which have looked very handsome.

To build Walls and greater Works of Flint, of which we do not want Examples in our Island, and particularly in the Province of *Kent*, (says Sir *Henry Wotton*) is, I conceive, says he, a Thing utterly unknown to the *Ancients*, who, observing in that Material a kind of metallick Nature, or at least a Fusibility, seem to have resolved it into a nobler Use; an Art now utterly lost, or perchance kept up but by a few Chymists.

Some Workmen say, that for building Flint or Boulder Walls, they use to have 12 s. *per* hundred (for so they phrase it) by which they mean 100 superficial Feet.

A Right and Left-hand Man fit well together for this Work, for they have a Hod of Mortar pour'd down upon the Work, which they part between them, each spreading it towards him-

ſelf, and ſo they lay in their Flints.

Their Mortar for this Work muſt be very ſtiff, and it is beſt to have a good Length of Work before them ; becauſe they work but one Courſe in Height at a Time ; for if they ſhould do more, it would be apt to ſwell out at the Sides, and run down.

They alſo ſay it is very difficult to make the Work ſtand in miſty Weather.

Boarded Walls.

Walls are ſometimes boarded, particularly the Walls of ſome Barns, Stables and other Out-houſes. But of this Kind of Work, ſee *Weather-Boarding*.

WALLS [for *Gardens*, &c.] The Poſition, Matter and Form of *Walls* for Fruit-trees, have great Influence on them for ripening the Fruit ; tho' Authors differ as to the Matter and Form of them, which ought to have the Preference.

The Reverend Mr. *Laurence* directs, that the Walls of a Garden be not built directly to face the four Cardinal Points ; but rather between them, *viz.* South-eaſt, South-weſt, North-eaſt and North-weſt ; in which the two former will be good enough for the beſt Fruit, and the two latter for Plumbs, Cherries, and baking Pears.

Mr. *Langford*, and ſome others propoſe, that Garden Walls ſhould conſiſt chiefly of Semi-circles, each about ſix or eight Yards in Front, and including two Trees ; and between eve two Semi-circles, a Space two Foot of *Plain-wall*.

By ſuch a Poſition, he ſay every Part of a Wall will e joy a Share of the Sun o Time with another ; beſide that the Warmth will be i creas'd, by the collecting a reflecting of the Rays in t Semi-circles, and the Tre within will be alſo ſcreen from injurious Winds.

Mr. *Fatio* propoſes to ha *Garden-walls* built ſloping, i ſtead of perpendicular, or r clining from the Sun ; that wh is planted againſt them may more expoſed to his perpend cular Rays ; which muſt ve much contribute to the ripe ing of Fruit in our cold C mate.

He directs, That the An of Reclenation be that of t Latitude of the Place ; th when the Sun is in the Me dian at the Equinoxes, Rays may ſtrike perpendicul ly ; yet others prefer *perp dicular Walls*, and even clining ones, or ſuch as ha forwards to the Sun ; becau ſuch will receive the Su Rays, perpendicularly, wh ſhe is low, as in *Spring* a *Autumn*, or in the Evening a Morning ; which they imag to be more ſerviceable than t greateſt Heats of the Sun *Mid-ſummer* upon *Reclini Walls.*

To this may be added, th in *Autumn* the Sun is m wanted to ripen *Winter* Pea in order to which they ſhou be kept dry, which cannot

do

done against sloping Walls; the Dews, &c. lying much longer on them, than on such as are perpendicular.

However Mr. *Fatio*'s sloping Walls have one great Advantage, *viz.* that Fruit-trees, as Vines, &c. being planted against them, close Glasses may be set on the Fruit, which will very much forward its Ripening.

As for the Materials of Walls for Fruit-trees, Mr. *Switzer* approves of Brick as the best, as being the warmest and kindest for the ripening of Fruits, &c. affording the best Conveniency for uniting,

But Mr. *Laurence* affirms on his own Experience, that Mud Walls, made of Earth and Straw, tempered together, are better for the Ripening of Fruit, than either *Brick* or *Stone-Wall*: and he adds, that a Copeing of Straw laid on such *Walls*, is a great Advantage to the Fruit, in sheltering them from perpendicular Rains, &c.

WALLING. Bricklayers commonly measure their Work by the Rod square, 16 Feet and a half; so that one Rod in Length, and one in Breadth, contain 272.25 square Feet; for 16.5 multiplied in it self, produce 272.25 square Feet.

But it is the Custom in some Places to allow 18 Feet to the Rod; which is 324 square Feet.

In some Places again, the Custom is to measure by the Rod of 21 Feet long, and three Feet high; which makes 63 square Feet; and in this Case they never regard the Thickness of the Wall; but the Custom is to make the Price according to the Thickness.

When you are to measure a Piece of Brick-work, you must first consider which of the foresaid ways it is to be done by, and then multiply the Length and Breadth in Feet together, and divide the Product by the proper Divisor, either for Rods or Roods, and the Quotient will be square Rods, or square Roods accordingly.

But usually Brick Walls which are measured by the Rod, are to be reduced to a Standard Thickness, *viz.* of a Brick and a half thick (if there has been no Agreement made on the contrary. And to reduce a Wall to a Standard Thickness, the following is

The RULE.

Multiply the Number of superficial Feet contained in the Wall, by the Number of half Bricks that Wall is in Thickness; and one Third of the Product will be the Contents in Feet, reduced to the Standard Thickness of a Brick and a half.

Example

Example 1. Suppoſe a Wall to be 72 Feet 6 Inches long, and 19 Feet 3 Inches high, and 5 Bricks and a half thick, how many Rods of Brick Work are contained in that Wall when reduced to the Standard?

$$\begin{array}{r} 19.25 \\ 72.\ 5 \\ \hline 9625 \\ 3850 \\ 13475 \\ \hline 1395.625 \\ 11 \\ \hline 3)15351.875 \\ \hline 272.25)\ 5117.291(\ 18 \text{ Rods.} \\ \hline 239479 \\ \hline 68.06)\ 21679\ (\ 3 \text{ Quarters of a Rod.} \\ 12.61 \\ \hline \end{array}$$

Anſwer, 18 Rods 3 Quarters 12 Feet.

$$\begin{array}{rcccc} & F. & & I. & \\ & 72 & & 6 & \\ & 19 & & 3 & \\ \hline & 648 & & & \\ & 72 & & & \\ & 18 & : & 1 & : 6 \\ & 9 & : & 6 & : 0 \\ \hline & 1395 & : & 7 & : 6 \\ & 11 & & & \\ \hline 3) & 15345 & & & \\ \hline 272) & 5115 & (\ 18 \text{ Rods.} & & \\ & 2395 & & & \\ \hline 68.) & 219 & (\ 3 \text{ Quarters of a Rod.} & & \\ & 15 & & & \end{array}$$

Note,

Note, That that 68.06 is one fourth Part of 272.25.

Note alſo, That in reducing of Feet into Rods, they uſually reject the odd Parts, and divide only by 72, as is done in the ſecond Way of the laſt Example; ſo the Anſwer by that ſecond Way is 18 Rods, 3 quarters, and 15 Feet, more by about 2 Feet and a half, than by the firſt Way, in which it is done decimally; but this Surplus is but very inſignificant.

Example 2. If a Wall be 245 Feet 9 Inches long, and 16 Feet 6 Inches high; How many Rods of Brick Work are contained in it, when reduced to a Standard Thickneſs?

```
        245.75
          16.5
      ---------
       122875
      147450
      24575
      ---------
      4054.875
          5
    -----------
    3)20270
  272) 6756 ( 24 Rods.
      -------
       1316
      -------
          24 ( 3 Quarters of a Rod.
```

Anſwer, 24 Rods, 3 Quarters, 24 Feet.

```
     F.      I.
    245      9
     16      6
   -----------
   1470
   245
    122  :  10  :  6
     12  :  00  :  0
   ------------------
   4054  :  10  :  0   The Anſ. in Feet.
```

I ſhall in the next Place ſhew how to find proper Diviſors to facilitate the Operation, becauſe it would be too intricate and tedious to perform by Scale and Compaſſes.

To find proper Divisors.

Divide 3, (the Number of half Bricks in $1\frac{1}{2}$) by the Number of half Bricks in the Thickneſs, the Quotient will be a Diviſor, which will give the Anſwer in Feet.

But if you would have a Diviſor, to give the Anſwer in Rods at once, then multiply 272.25 by the Diviſor found for Feet, and the Product will be a Diviſor, which will give the Anſwer in Rods.

Example, To find a proper Diviſor to reduce a Wall of 3 Bricks thick.

Divide 3 by 6 (the half Bricks in the Thickneſs) and the Quotient will be .5, which is a Diviſor that will give you the Anſwer in Feet.

Then multiply 272.25 by .5 and the Product will be 136.125, which is the Diviſor that will give the Anſwer in Rods; that is as 136.125 is to the Length of the Wall, ſo is the Height to the Content in Rods; or as .5 is to the Length, ſo is the Height to the Content in Feet.

After the ſame Manner you may find Diviſors for any other Thickneſs, which you will find to be, as expreſs'd in the following Table.

The Thickneſs of the Wall.	Diviſors for the Anſwer in Feet.	Diviſors for bringing the Anſwer in Rods.
1 Brick thick	1.5	408.375
$1\frac{1}{2}$ Brick thick	1	272.25
2 Bricks thick	.75	204.1875
$2\frac{1}{2}$ Bricks thick	.6	163.35
3 Bricks thick	.5	136.125
$3\frac{1}{2}$ Bricks thick	.4285	116.678
4 Bricks thick	.375	102.0937

Let the ſecond Example preceeding (where the Length is 245.75, the Height 16.5, and the Thickneſs $2\frac{1}{2}$ Bricks) be wrought by Scale and Compaſſes. Thus,

Extend the Compaſſes from 163.35 (the Tabular Number againſt $2\frac{1}{2}$ Bricks) to 245.75, and that Extent will reach from 75.5 to 12.13; that is 12 Rods and a little above half a Quarter.

Again,

Again, if the Length be 75 Feet 6 Inches, and the Height 18 Feet 9 Inches, at 3 ½ Bricks thick, how many Rods are contained therein?

Extend the Compasses from 116.678 (the Tabular Number) to 18.75. that Extent will reach from 75.5, to 12.13; that is 12 Rod, and a little above half a Quarter.

It will be very proper and convenient, for such as frequently measure Brick Work, to have in the Line of Numbers, little Brass Centre Pins, at each of the Numbers in the third Column of the foregoing Table, with a Figure to denote the Thickness of the Wall.

If a Wall be 104 Feet 9 Inches long, and 17 Feet 3 Inches high; How many Rods does it contain?

```
        104.75
         17.25
       -------
         52375
        20950
       73325
      10475
    ----------
63 ) 1806.9375 ( 28
     126
     ---
      546
      504
      ---
       42
```

Answer, 28 Rods, 42 Feet.

F.	I.	
104	9	
17	3	
728		
104		
26	02	3
12	09	0
1806	11	3

Note,

Note, That those who dig Cellars, do many Times do them by the Floor, 16 Feet Square, and a Foot deep being a Floor of Earth; that is 324 solid Feet.

WASHING [in *Painting*] is when a Design drawn with a Pen or Crayon, has some one Colour laid over it with a Pencil, as *Indian* Ink, Bistre or the like, to make it appear the more natural, by adding the Shadow of Prominences, Apertures, &c. and by imitating the particular Matters, whereof the Thing is suppos'd to consist.

Thus they wash with a pale Red to imitate Brick and Tile; with a pale *Indian* Blue, to imitate Water and Slate; with Green, for Trees and Meadows; with Saffron or *French* Berries, for Gold or Brass; and with several Colours for Marbles.

These Washes are usually given in equal Teints or Degrees throughout; which are afterwards brought down and softened over the Lights with fair Water, and strengthened with deeper Colours for the Shadows.

WASHING *of Colours*. Some Colours are of such a gritty, sandy Nature, that it is impossible to grind them so fine as some curious Works require; therefore in order to get forth the Flower and Fineness of the Colour, you must do thus;

Take what Quantity of Colour you please to wash, and put it into a Vessel of fair Water, stir it about till the Water be all colour'd therewith, and if any Filth swim on the Top of the Water, scum it clean off, and when you think the grossest of the Colour is settled at the Bottom, then pour off that Water into another earthen Vessel, that is large enough to contain the first Vessel full of Water four or five Times; then pour more Water into the first Vessel, and stir the Colour that remains till the Water be thick; and after it is a little settled, pour that Water also into the second Vessel, and fill the first Vessel again with Water, stirring it as before; do this so often, as till you find all the finest of the Colour drawn forth, and that none but coarse gritty Stuff remains in the Bottom; then let this Water in the second Vessel stand to settle till it is perfectly clear, and that all the Colour be sunk to the Bottom; which when you perceive, then pour the Water clear from it, and reserve the Colour in the Bottom for Use, which must be perfectly dry'd before you mix it with Oil to work.

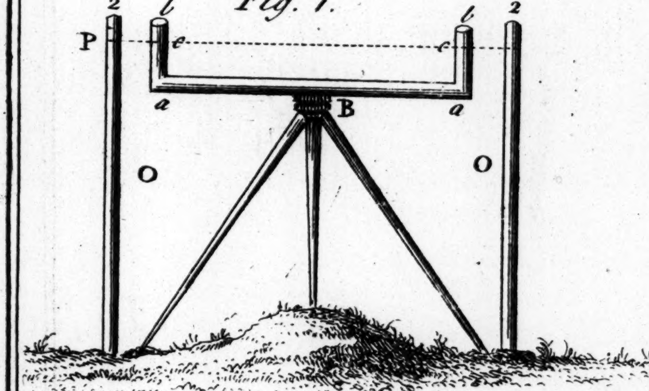
The Colours thus ordered, are *Red Lead*, *Blue* and *Green Bice*, *Verditer*, *Blue* and *Green Smalt*, and many times *Spanish Brown*, when you would cleanse it well from Stones for some fine Work, as also *Yellow Oker*, when you intend to make *Gold Size* of it.

WATER *Colours* [in *Painting*] are such Colours as are only diluted and mix'd up with Gum Water, in Contradistinction to *Oil Colours*.

Water Colours are us'd in

what

Fig. 1.



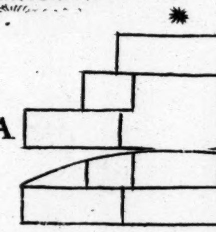
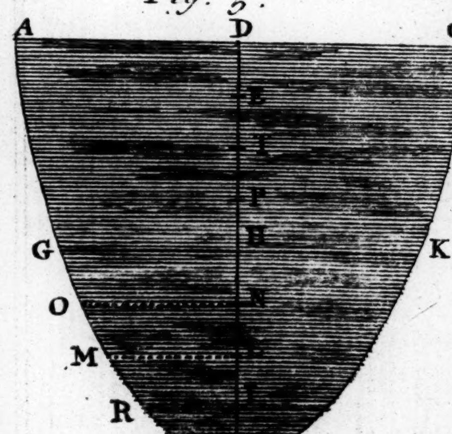


Fig. 3.



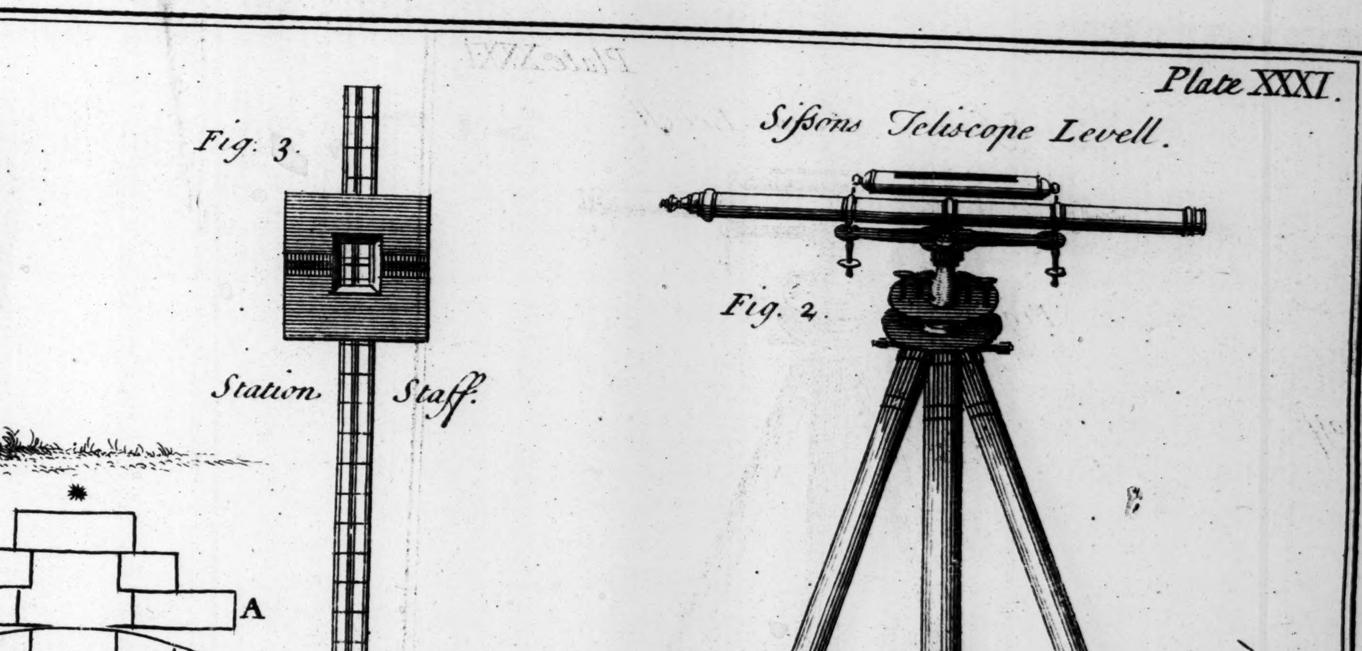


Plate XXXI.
Sissons Teliscope Levell.
Fig. 3.
Fig. 2.
Station Staff.
A
Fig. 4.
E
D
C
A
B
Fig. 6.
Tarras.
ah
ah
Verge
Canal
Verge
Talu
Pallisade
31

hat we call *Limning*; as *Oil* *Colours* are in Painting, properly so call'd.

WATER TABLE [in *Architecture*] is a Sort of Lodge left in Stone or Brick Walls, about 18 or 20 Inches from the Ground (more or less) from which Place the Thickness of the Wall is abated (or taken in) the Thickness of a Brick.

In Brick Walls two Inches and a $\frac{1}{4}$; thereby leaving that Ledge or Jutty that is call'd a Water Table.

These *Water Tables* are sometimes left plain, and sometimes they are wrought with Mouldings; if the latter (besides the plain Measure of the Wall) they are rated at so much *per* Foot, running Measure.

WATER COURSES. These are commonly rated by the Foot running Measure. If the Workman find Materials, about 10 *d.* *per* Foot; if he find no Materials, about 8 *d.*

As to the Conveyance of Water from the Tops of Houses and Balconies,

It is enacted by an Act of Parliament made in the XI. Year of King *George* I. that the Water falling from the Tops of Houses, after the 24th of *June* 1725 within the Cities of *London* and *Westminster*, or their Liberties, from their Balconies, Pent-Houses, &c. shall be convey'd into the Channels by Party Pipes, fix'd on the Sides or Fronts of the said Houses; on the Forfeiture of ten Pounds for every Offence.

WATER being an Element so absolutely necessary to all Manner of Habitations, and being not always to be found near enough to them for Use; it will not be improper to consider by what Means it may be found, and how it may be conducted.

The learned VARENNIUS in his System of *General Geography*, tells us from *Vitruvius*, that if Fountains do not flow of their own Accord, their Heads are to be sought for under Ground, and so collected together. Which Springs may be discovered in the following Manner: If you lie down on the Ground, in Places where you would seek for them, before the Sun rises, and having plac'd your Chin as close as you can, till it is, as it were, prop'd by the Earth, so that the adjacent Country may be plainly seen; (the Reason of this Posture is, that by this Position the Sight will not wander any higher than it ought): if you keep your Chin unmov'd, it will give a certain Definition and true Level of the Parts where you are plac'd, and in those Places where you see Vapours gathering themselves together and rising up into the Air, there you may dig; for this Sign never happens in a dry Place.

2. *Coronarius* and some of the Ancients, intimate, that wherever the Twig-withy, Flea-bane, Reeds, Trefoil, Pond-Grass and the Bull-Rush grow very plentifully, there you may

most

most probably find Water; and he directs to find it by the following Experiment.

By digging a Ditch three Foot deep, and having a leaden Vessel or Earthen Pot, made in the Form of a Semi-Circle, rub it over with Oil at Sun-set; then having a Piece of Wood half a Foot long, well wash'd and afterwards dry'd, tie this on a small Stone on the middle of it, and fix it on the middle of the Pot or Vessel with Wax: Having done this, turn the Mouth of the Pot downwards, in the Trench that has been dug, taking Care that the Wool hang down in the middle of the Vessel; then cover the Vessel with Earth, to the thickness of a Foot, and leave it till the next Morning; and if at Sun rising you uncover it, and perceive small dewy Drops hanging on the Bottom, and the Wool wet, there is Water in the Place.

If the Wool be very full of Water, and the Drops hanging on the Pot be very large, you may thence conclude you are not very far from the Spring; but if it be only moist, tho' there be a Spring in that Place, yet you may conclude that it lies very low, and not to be come at, without great Pains and Charge: But if you do not find these Symptoms, you must make the Experiment in another Place.

Water may also be discover'd by the Nature of the Soil. If it be a black fat Soil, and abound with Pebbles of a black or yellowish Colour, you need not fear wanting Water in such a Place.

Again: If the Soil be glutinous or clayey, you may expect to find Water in it.

Again, Water or Springs may be discovered by the natural Produce of the Soil (as before) as where Water-Plantane, the Sun-Flower, Reed-Grass, Oxbane, Brambles or Shave-Grass, Calamint, Mat-Rushes, Maiden-Hair, Melilot, Sower-Sorrel or Ditch-Dock, Cinquefoil, Blood-wort, Night-Shade, Water Milfoil, or Coltsfoot grow, there you will find Springs, and where they grow in most Abundance, there you will find the most plentiful Springs.

Some make use of the following Experiment for finding Water. They dig a Ditch a Foot broad and 3 Feet deep, and about the middle of the Day, hang a dry Spunge in the midle of it for 3 Hours, covering it close with large Reeds; and if the Spunge, when it is taken from thence, is wet, they take it for an assured Sign that there is Water there, and proceed to dig; but if on the contrary the Spunge is dry, they conclude it is in vain to search for it there.

Coronarius informs us from *Democritus*, that the Discoverers of Water aver, that flat and extensive Plains are commonly most destitute of Water; whereas rising Grounds seldom fail of abounding with it; and that those Eminences, which are most shaded with Trees, have generally the greatest Share of it.

Others

Others of the Antients say, that wherever you can discover Swarms of Flies, hovering and pitching about one and the same Place, they are certain Signs that Water is there.

Most of these Observations of the Antients are agreable to those of modern Practitioners.

The several Kinds of Weeds, before mentioned, are certain Indications, that Water (if it does not break out) is near at Hand. And to this it may be added, that those kind of Herbs grow on moorish black Land, on the Sides of Hills, and where the Ground is mixt with Pebbly Gravel or Rock, that is of a dusky brown sandy Colour.

But there is not a more certain Sign of Water in the World, than where Alder-Wood grows naturally and of its own Accord: and even the Oak it self is found to grow on moist Hills.

After this short Account of the Methods of discovering of Springs, their Situation, &c. I shall next proceed to the Operation it self.

Those who have been conversant in Mines and Coal-works, observe that there are two Sorts of Springs; those that lie near the Surface, and are suppos'd to proceed intirely from Rain; and those that lie deeper and proceed from a more remote Cause.

It would then be dangerous to dig deeper than the Surface where they first appear, lest they should take a wrong Current, and instead of breaking out Side-ways, should sink beneath their Cause, and be lost in the Crannies and Openings of such Rocks of Stone and Gravel as lie contiguous thereto; but those are either stronger or weaker, according as they happen to lodge or fall on Earths, which are in their Nature more or less glutinous and clayey, and consequently tenacious of Water; or are otherwise of a more arenaceous, gravelly, sandy, or of a drying Chalk and whitish Earth; or which is very common, of a flinty or hollow Substance. These uppermost Springs must therefore be sought after with Caution; but as to such as lie lower, there is no Fear of Injury.

As to the Quality of WATER.

Those who seek for Water, should first consider what the Places are in which Water is to be found.

In the following Places Springs are certain and good: In Chalk, some say, it is fine, but rises not very high; this is reckon'd the best Water of all.

In sandy Gravel also it is fine; but if it is found in low Places (these are generally Rain Springs) and then it will be muddy and unsavoury; but in black Soils, there are fine thin Distillations found, which are collected as they subside from Winter Rains in clayey Grounds, and those have the best of Tastes.

In Ground which is a clear Gravel, Springs abound but

little, and the Veins are not certain; but those are extraordinary sweet.

In large, pebbly Gravel, and in Sand, Stone or loose Veins of Coal, they are more stable and certain, and these have all a good Taste.

They are plenty also in Red Stone, and good, if they don't slip away, and run off through the Interventions thereof.

They flow plentifully also under the Foot of Mountains, and in Stony Places: these are very cold, but very healthy; but the Water that is found in Champion open Places (such as the Water is in all stagnated Ponds) is thick, betwixt hot and cold, and not sweet, except it be that which springs out of the Bottom of Mountains, and runs into the middle of large Plains: and where they are shaded with Trees, there they excell the Sweetness of Mountain Springs.

The Manner of discovering Springs having been before treated of, the next Thing to be considered, is the taking the exact Levels, and making proper Allowances for the Curvature of the Earth, and adjusting the Fall or Current, which is generally allow'd for the Descent of Water.

For taking of Levels, especially those that run any Distance, the following Instruments are in the most Esteem.

Of these Instruments or Levels there are various Sorts; of which I shall take Notice of but two or three.

Of all the *Levels* which have been produc'd, there i none for Portableness, Cheap ness, Certainty and Dispatch exceeds that which follows; i being what may be made o purchas'd for 8 or 10 s. wherea several other *Levels* will co five or six Pounds.

This *Level* is a Tube mad of Brass or other-like soli Matter, about three Foot lon and 12 or 15 Lines Diamete whose Ends are turn'd up Right Angles, for receiving tw Glass Tubes, three or four In ches long, fasten'd on the with Wax or Mastic; at th middle and underneath th Tube, is fix'd a Ferril, f placing it upon its Foot: Th *Level*, tho' it be a very simp one, is very commodious f levelling small Distances, sa M. *Le Bion*.

An Instrument founded up the same Reasons, tho' n made exactly in the same Ma ner, is describ'd as follows: consists of a Piece of Heart Oak, of two Inches square, the middle of which was a lar Groove, into which was fix'd Tin Tube, of about two an half or three Foot long; bei the Length of the Piece of Wo turn'd up at the End, i which at *a a* were put in t Tubes of Glass, of an eq Length, reaching to *b b*; n into either Ends of the Gl Tubes, which are always op you may pour in Water so hi till it reaches the prick'd L *c c*, or thereabouts.

This Instrument may be fi on a Tripos, or a plain Tab or any other Instrument for S

veyi

veying, is slipp'd into it at B; and if it be manag'd with any kind of Dexterity or Discretion, it will immediately form a *Level*, as *c c*, before mentioned, which tho' it be farther off or nearer to *a a*, is not material; the Water which is in the Tube naturally resting in the Level, over which you are to take your View. See *Plate*, *Fig.* 1.

But if you have a Mind to enlarge your View a great way, you may frame in a little Post on one Side of your Level at D, which shall have a Screw fix'd into it at P, and may be either rais'd higher or lower at pleasure, as your Water is in the Tubes, through which you may have Sight to look at 2, 2, as you do thro' other Levels.

The Rationale of this and all Levels of this Kind, are, that Water naturally places it self level; and therefore the height of the Water in the Glass Tubes, will be always the same in Respect to the Centre of the Earth.

The next I shall mention is the *Telescope Spirit Level*, a genteel and ingenious Instrument, accounted the Invention of Mr. *William Sisson*, being of great Use for those who are to take the Dependance of a River (or any other Length) of 15 or 16 Miles or more.

This Instrument consists of a Brass Telescope, of a convenient Length, the longer the better, provided the Parts of the Instrument which support it, be proportionably strong.

Within this Telescope is fix'd a Hair, and a small Micrometer, whereby the Distances may be determined at one Station, near enough for the Business of levelling; upon this Telescope is fix'd with two small Screws, the *Spirit Tube* and *Bubble* therein, which *Bubble* will rest exactly in the middle of the Tube, when the Telescope is set truly level.

Under the Telescope is a double Spring, with two Screws, by which the Bubble is brought exactly to a Mark in the middle of the Tube; to which Spring is fix'd a conical Ferril, which is a Direction for the Telescope to move horizontally at Pleasure.

There is also a three-legg'd Staff, a Ball, Socket, and four Screws, to adjust the horizontal Motion, the same with that belonging to all Surveying Instruments. See *Plate*, *Fig.* 2.

For your Assistance to this, and the other Levels before-mention'd, you must be provided with two Station Staves, represented, *Fig.* 3. each ten Foot long, that may slide one by the Side of the other to five Foot, for the easier Carriage; these must be divided into 1000 equal Parts, and numbred at every tenth Division 10, 20, 30, 40, *&c.* till you come to 1000; but every centesimal Divisions (which is the most that can be express'd in the Figure before-mentioned) as 100, 200, 300, *&c.* to 1000, ought to be express'd in large Figures, that the Division may be more easily counted; and

you may alſo have another Piece, five Foot long, divided alſo into 500 equal Parts, to be added to the former, when you ſhall ſee Occaſion.

Upon theſe Staves are two Vanes or black Boards made to ſlide up and down, which will alſo ſtand againſt any Diviſion on the Staff, by the Help of Springs; theſe Vanes are beſt made 30 Parts wide, and 90 Parts long; let the Faces of them be divided into three equal Spaces; by two Lines drawn Length ways; let the two extreme Parts be painted white, and the other two black, which will render them fit for all Diſtances. See *Plate, Fig.* 3.

When you are thus provided with a good Inſtrument, two Station Staves, a Chain and two Aſſiſtants, you may proceed to your Work; but firſt it will be neceſſary to know if your Inſtrument be well adjuſted.

Now to do this, you are to chuſe ſome Field or Meadow, which is nearly level, and ſet down the Inſtrument about the middle thereof, and make a Hole in the Ground under the Centre of the Inſtrument, from which meaſure out a Right-Line, ſome convenient Length as 20 Chains, and there leave one of your Aſſiſtants with his Station Staff; and then return to the Inſtrument, and meaſure out the ſame Number of Chains, *viz.* 20 the other way: by the Direction of the Inſtrument and laſt Station Staff, as near in a Right-Line as you can gueſs, and there leave your other Aſſiſtant with his Station Staff; ſo will the Inſtrument and Station Staves be in a direct Line

Then return to the Inſtrument, and ſet it horizontal which is preſently done b Ball and Socket, and turn th Teleſcope about on its horizontal Motion to your firſt Aſſi tant, and move the Teleſcop by the two Screws in the doubl Spring, till the Bubble reſt exactly in the middle of th Spirit Tube; then obſerv where the Hair cuts the Staf and direct your Aſſiſtant t move or ſlip the Vane or Boar up and down, till the Hair cu the middle thereof, ſo that yo can ſee as much of the Van above the Hair, as is below i and there give him a Sign fix it; then direct the Teleſcope towards your ſecond Aſſiſtant, and proceed in th ſame Manner; ſo are the Van on each Staff, equi-diſta from the Centre of the Eart

Remove the Inſtrument that Aſſiſtant which is neare the Sun, that you may ha the Advantage of the oth Aſſiſtant's Vane, and there down the Inſtrument, as ne the Staff as you can; th having ſet the Inſtrument ho zontal, ſo that the Bubble re in the middle of the Tube, o ſerve what Direction is then c by the Hair in the Teleſco above or below the middle the flat Board or Vane; for many Diviſions muſt the oth Aſſiſtant's Vane be elevated depreſs'd, which you muſt dir him to do accordingly.

Here the Diſtance of the ſtrum

ſtrument from the Station Staff is 40 Chains, for which you muſt make an Allowance for the Earth's Curvature, which, by the following Table you will find to be 16 $\frac{6}{10}$ Parts; therefore let the Vane on the Staff be raiſed 16 $\frac{6}{10}$ Parts.

Then direct the Teleſcope to the Vane thus raiſed, and if the Hair cuts the Middle there-of, while the Bubble reſts in the Middle of the Tube, the Inſtrument is right, but if not, aiſe or depreſs the Teleſcope y the Screws in the double pring, till the Hair cuts the iddle of the Vane, and then the Help of the Screws that ed the Tube to the Tele-pe, move the Bubble, till it ſts in the Middle of the Tube, is the Level adjuſted.

As to the Allowances to be ade for the Curvature of the rth, when the Station Staves planted at unequal Diſtan-from the Inſtrument, you ſt take the following Me-d.

Suppoſe the Inſtrument was ed on an Eminence be-en two Valleys A and B, the firſt Aſſiſtant ſtanding h his Station at C, and the nd at D, and it is required ow the different Height e Hills C and D.

irſt, Set the Inſtrument ho-tal, and then direct the ſcope to the firſt Aſſiſtant's Staff at C, and by the Spring Screws, ſet the Bubble exact, obſerving where the Hair cuts the Staff, and by Signs cauſe him to move the Vane higher or lower, till the Hair cuts the Middle thereof, and then give him a Sign to note down the Diviſion, cut by the upper Edge of the Vane, which ſuppoſe 104 Parts from the Ground, and by the Micrometer in the Teleſcope, find the Diſtance from the Inſtrument to the Staff C, to be about 10 Chains.

Then direct the Teleſcope to D, and proceed in the ſame Manner as before, and find that the Hair cuts 849 Parts from the Ground, and by the Micrometer, the Diſtance to D, is determined to be about 35 Chains.

Next look into the Table of Curvature following, and find againſt 10 Chains, one Part to be deducted for the Curvature of the Earth at that Diſtance, ſo will the Aſſiſtants Note be made 103 Parts.

Alſo againſt 35 Chains you will find $\frac{7}{1210}$ which being deducted out of 489, there remains 836 $\frac{3}{10}$, which muſt be noted by the ſecond Aſſiſtant.

Now if the 103, as noted by the firſt Aſſiſtant, be ſubtracted from 836 $\frac{3}{10}$, as noted by the ſecond, the Remainder will be 733 $\frac{3}{10}$, and ſo much the Hill *c* is higher than the Hill *d*.

A TABLE of the Earth's Curvature, calculated the Thousandth Part of a Foot, at the End of eve Chain, from one Chain to 40.

Chains.	Dec. Feet.	Chains.	Dec. Feet.	Chains.	Dec. Feet.	Chains.	Dec. Feet
1	000	11	013	21	045	31	099
2	000	12	015	22	050	32	106
3	001	13	017	23	055	33	113
4	002	14	020	24	060	34	120
5	003	15	023	25	065	35	127
6	004	16	026	26	070	36	134
7	005	17	030	27	075	37	141
8	007	18	033	28	081	38	149
9	008	19	037	29	087	39	157
10	010	20	041	30	093	40	16

Thus you have a Table of the Curvature of the Earth; but, if you have not the Table at hand, or the Number required be not to be found therein, then you may find the Allowance which is to be made at any Distance by the following Rule.

Multiply the Square of the Chains by 31, and divide the Product by 300000, and you will have the Answer.

In this Manner, by making an Allowance for the Curvature of the Earth, you may send a Station Staff forwards half a Mile or farther, from the Instrument, and take a Sight over Valleys at once; the horizontal Distance being in this Case the only Thing to be regarded.

I shall now come to the Operation, by which it may known, whether Water be conveyed in Pipes or T ches, from a Spring-head any determined Place.

At the Spring-head, se one of your two Station St as nearly perpendicular as can, and leave with one of Assistants, proper Direct for raising or depressing Vane on his Staff, accordi certain Signs, which you, st ing at your Instrument, give him. Also let him be vided with Pen, Ink and P to note down very carefull Division of the Staff whic Vane shall cut, when you a Sign that it stands in its Position.

Carry your Instrumen wards the determined Plac

re going to, as far as you can ee them; so that thro' the Telescope you may but see any Part of the Staff left behind, when the Instrument is set ho-izontal; and from that Place end your Assistant forward with his Station Staff, with the ame Instructions which you gave at first.

Set the Instrument, by the Help of the Ball, Socket, and Screws, and direct the Tele-cope to your first Assistant's Staff, and then by the Help of he Spring-Screws, bring the Bubble exactly to the Middle f the Tube, and when it rests here, give a Sign for your Assistant to note the Parts of the Staff.

Turn about the Telescope o your second Assistant's Staff, nd by the Spring Screws as efore, set the Bubble exact; hen direct your second Assist-nt to move the Vane higher r lower, till you see the Hair n the Telescope cuts the mid-le of the Vane or Sight-board; but in long Distances the Hair ill almost cover the Vane; owever let it be set in such Manner, that as much may e above the Hair as below it, s near as you can guess) and en give him a Sign to note e Division upon the Staff; d always let your Assistants te the Division cut by the up-r Edge of the Vane.

Let your first Assistant then ing his Station Staff from the ring Head, and changing aces with the second Assist-, let your second Assistant ry his forwards to the deter-mined Place, to which you are going, and at a convenient Dis-tance erect it perpendicular, whilst your first Assistant tar-ries with his Staff, where your second Assistant stood before.

Place your Instrument be-tween your two Assistants, as near the middle as you can, on account of the Curvature of the Earth, and first direct your Telescope to your first Assist-ant's Staff, and when the Te-lescope is levelled to one of the Divisions on the Staff, let him note that Division in an order-ly Manner, under the first Ob-servation; and let the second Assistant do the same.

And in this Manner proceed over Hill and Dale, as strait forwards as the Way will per-mit, to the appointed Place (only repeating these Directions) tho' it be 20 Miles distant from the Spring Head.

But in the whole Passage, let this be a constant Rule, from which you must never depart, *viz.* that your first Assistant must at every Station stand be-tween the Spring Head and your Instrument, and your se-cond Assistant, must always stand between the Instrument and the appointed Place to which the Water is to be con-veyed; and also the first Assist-ant must be sure to place his Staff exactly in the Place where the second stood.

Being come to the Place ap-pointed, let both your Assist-ants give in their Notes, which ought to stand in the Manner and Form following.

First Assistant's Notes.		*Second Assistant's Notes.*	
Stations.	Parts.	Stations.	Parts.
1	1029	1	1325
2	529	2	634
3	695	3	743
4	793	4	898
5	821	5	762
6	1378	6	1354
7	724	7	891
8	227	8	1449
9	465	9	532
10	732	10	891
11	321	11	654
12	621	12	1531
Sum	8335	Sum	11364

When you have taken the Levels, and summ'd up the same, you will find the Difference of the two Assistant's Notes to be 3029 Parts, which is about 3 Foot ½. But that you may be the more certain, it is best to try the same in another Tract, and by another good Instrument, and it may happen to be the same, which it will be very near, if the same has been rightly survey'd.

Where note, that if in the making the second Experiment, tho' you take more Stations than at the first, yet the Notes compar'd together will be, if not equal, yet will differ but very little in the Parts.

Note, If from the first Assistant's Staff you measure any Number of Chains towards the Place you are going to, as suppose 20, and then set dow[n] the Instrument, and then mea-sure ten Chains forwarder, and there place the other Station Staff, you will have no Occa-sion to make any Allowance for the Curvature of the Earth, be-cause the Instrument being planted in the Middle of the Distances between the Station Staves, the Errors mutually destroy one another.

But this measuring the Dis-tances, with the Chain or o-therwise, is very tedious, and in some Places (where the Ground is very uneven) un-practicable, unless you make a Multitude of Stations; so if the Way between the two deter-mined Places, whose differen[t] Heights you would know, lie over Hills and Dales, then you must in that Case make four or fiv[e]

five Stations, otherwiſe yon will not be able to ſee any Part of the Staff, when the Inſtrument is ſet horizontal, which might as well be done alone, as in the foregoing Obſervations, in the Manner deſcribed in the Table of Curvatures.

For the common Occaſions of Levelling to be performed without much *Apparatus* of Inſtruments, Time or Trouble, the following Method is recommended.

Set a Pole upright in a Spring, Pond, River, or other Place, whence Water is to be brought, and mark how many Feet and Inches of it are above Water.

Then ſet up another Pole of equal Length with the other in the Place to which the Water is to be brought.

Place the Centre of a Quadrant on the Top of this laſt Pole, ſo that the Plummet may hang free; ſpy through the Sights the Top of the Pole that is ſet up in the Water, and if the Thread cuts any Degree of the Quadrant, the Water may be conveyed by a Pipe laid in the Earth.

But if you cannot ſee from one Pole to the other, the Operation muſt be repeated.

Dr. *Halley* ſuggeſts a new Method of Levelling, which has been put in Practice by ſome of the *French* Academy: This is performed wholly by means of the Barometer, in which the *Mercury* is found to be ſuſpended to ſo much the leſs Height, as the Place is farther remote from the Centre of the Earth.

Hence it follows that the different Height of the Mercury in two Places, gives the Difference of the Level.

Dr. *Derham* from ſome Obſervations he made at the Top and Bottom of the Monument, found, that the Mercury fell $\frac{1}{10}$ of an Inch at every 82 Foot of perpendicular Aſcent, when the Mercury is at 30 Inches.

Dr. *Halley* allows of $\frac{1}{10}$ of an Inch for every 50 Yards; which conſidering how accurately Barometers are now made, an Inch in ſome of them being divided into 100 or more Parts, all very ſenſible, he thinks this Method ſufficiently exact to take the Level for the Conveyance of Water, and leſs liable to Error than the common Levels.

The ſame Author found a Difference of 3 Inches 8 Tenths between the Height of the Mercury at the Top and Bottom of *Snowdon* Hill in *Wales*.

Of the proper Methods to be taken in adjuſting the Levels or Falls from a Spring-head, ſo as to conduct them by a gradual Deſcent to the Houſe, or other Place required.

The Deſcent from the Spring Head to the Reſervoir being taken, the next Thing to be done, is to determine what Fall the Water is to have, or in other Words, how many Feet or Inches, or how much Dependance is to be allowed to a Yard, to a Pole, to 100 Feet or Yards, or a Mile or Miles in Proportion, ſo as that the Water may have a proper Current

rent, and may at laſt not fall too low, but be brought gradually to the Top of the Reſervoir or Pond where it is to be uſed.

But before we proceed to the Adjuſtment of the Dependance or Fall of Water, it will not be improper to enquire into the Fall of ſome Aqueducts and Water-courſes, both at Home and Abroad, ſince 'tis from Fact rather than Theory and Speculation, that the certain Conſequences of this or any other Employ muſt be deducted.

Vitruvius tells us, that the *Romans* allowed for the Channels or Sewers of their Aqueducts for every 100 Feet, running half a Foot of Declination or Sloping (which is near 27 Foot in a Mile) and if any Hills were in their Way, they dug thro' them, making Vents to give Air at convenent Diſtances; they not being apprized in that early Dawn of Hydroſtaticks, that if you would confine your Spring in Leaden Pipes, it would riſe over Hill and Dale, if the Spring-head were ſo high as to over-top them, proper Allowance being made for Friction, and the Interpoſition of Air, which may be let out by Wind-cocks, as ſome Authors have taught.

The ſo much famed Aqueduct of *Claudius*, was (as Mr. *Addiſon* informs us) five Foot and a half in a Mile; but whether he means an *Italian* or *Engliſh* Mile does not appear; but if it be an *Engliſh* Mile, Experience informs us it is an Allowance large enough, tho' it were not to be above a Foot Fall in 1000.

Varenius in his Geography relates, from ſome *French* Writers, that the *Seine*, out of which the Water is carried from the *Armory* at *Paris*, to the *Royal Gardens*, is ſcarce one Foot Fall in 500 Fathoms, every Fathom being 6 Foot; now 500 being multiplied by 6, the Product is 3000 Feet, which is half a Mile, and 260 Feet, if accounted in the *Engliſh* way; by which it appears that the Fall is about two Foot in a Mile: but later Experience ſhews, that Water will deſcend in leſs than that. The Water-courſe at *Plymouth* is ſaid to be but five Inches in a Mile-Fall; and one made ſome Years ſince, by Mr. *Stephen Switzer*, for the Earl of *Coningsby*, but about four.

The *New River*, according to the Relation of Mr. *Mills* the chief Surveyor of that Work, is in the mean, but between 3 and 4 Inches Fall in a Mile; tho' in ſome Places it be more, and in others leſs: And Sir *Jonas Moore* is ſaid to allow but 3 Inches; and the ſame is practiſed in the Fens of *Lincoln* and *Cambridgeſhire*, where the Water is almoſt of a deadiſh Flat; but the general Allowance is 4 Inches and a half by all Ingeniers.

To conclude this, the conducting of Water varries according to the Conveyances in which it is carried.

Water conveyed in Pipes, especially if they are ſmall, requires more Dependance than any other Way, on account of the Friction there is againſt the Sides of the Pipes, as well as Wind-boundneſs that generally they are liable to.

That which is conveyed in Drains, will paſs more eaſily and freely; but Water paſſing in an open Carriage, will paſs the moſt free of all; except the Winds are againſt the Stream, becauſe of that continual Agitation and Pulſion that there is in the Air.

But to come to Practice: Suppoſe the Length the Water is to be conveyed is 1000 Yards, and the Fall from the Spring-head to the Reſervoir or Houſe, is 25 Foot 9 Inches, and it ſhould be required to know how many Inches or Parts of an Inch muſt be given to every Yard or Pole, in order to give this Water its proper and gradual Deſcent or Fall.

In the firſt Place, you muſt reduce the 25 Foot 9 Inches into Inches, which make 309; but thoſe not being brought into Terms low enough to be divided by 1000, you muſt reduce the 309, multiplying by 12, to bring it into Lines or Parts of an Inch, the Produce of which will be 3708, as is ſeen by the Operation.

F.		In.
25	:	9
12	:	0
300	:	0
9		
309	:	0
12	:	0
1|000)3|708	:	0(

Which being divided by 1000 the Number of Yards contained in the Length, the Quotient will be 3 Lines $\frac{708}{1000}$ of a Line, which is near 3 Lines $\frac{3}{4}$, or a Quarter and $\frac{3}{4}$ of an Inch; however you may allow it a Quarter and half Quarter, which is 4 Foot 7 Inches in a Mile, and have to ſpare, and to anſwer for any Error or ſmall Miſtake that may happen in carrying on the Work.

Suppoſe farther, that the Length of this Fall of 25 Feet 9 Inches, be 4 Miles and a Quarter, and it is required to know how many Feet or Inches it is proper to allow in a Mile, or any Part or Quantity of a Mile?

Firſt reduce the four Miles and a Quarter, into Quarters of a Mile, which making 9, by ſuch Multiplication, divide the 25 Feet 9 Inches by 9, and the Quotient is the Anſwer.

Example.

EXAMPLE.

F.	In.
25	: 9
12	: 0
9)309	: 0(34 ⅓
39	: 0
34	: 3

And the Anſwer is 34 ⅓ Feet, or two Foot 10 Inches ⅓; and ſo much muſt be allowed for the Fall in a Quarter of a Mile, which is 1 Foot 5 Inches in a Furlong; and a little more than one Line or one Twelfth of an Inch to a Pole, and 11 Foot and ½ in a whole Mile, a very good Dependance for the Paſſage and Conveyance of Water where it can be had.

But there are other Things to be conſidered, in relation to the Conveyance of Water in Pipes, *i. e.* Friction, Windboundneſs, *&c.* becauſe as M. *Mariotte* obſerves (and that from curious Experiments) that Water never riſes to its own Level, on account of the Friction that is on the Sides of the Pipes, which Friction increaſes the longer the Diſtance is.

Now to adjuſt this Stoppage or Friction as near as may be, the general Rule among Workmen is to allow one eighth of the Height for the Interruption it meets with in its long Paſſage.

So that if the Deſcent from a Spring-head to the Reſervoir be 128 Foot, you are according to this general Rule, to divide it by 8, and the Product will be 16.

Which ſhews that the Water will not riſe ſo high as the Spring-head by 16 Feet.

But Monſieur *Mariotte* (to whom we are ſo much indebted for his *Hydroſtaticks*) has brought this Matter to a more exact Calculation, producing it as a certain general Rule, *That the Difference of the Height in* Jets d'eau, or in other Words, *the Deſcent of the Water from its Head to the Reſervoir, or Place aſſigned for the Reception of it, is in a ſubduplicate* Ratio *of its Height.* And tho' 'tis certain, that he made Uſe of this Rule to demonſtrate the Riſe of Jets in the open Air; and as external Air has undoubtedly a greater Effect on the Riſe of Water, than the Friction againſt the Sides of the Pipes, we may be the more ſure, that if there be any Error, it is on the right Side, and that without any great Deviation from Truth, it may be applied to the Friction that is in incloſ'd Pipes.

But to proceed upon the Foot of the foregoing Rule, it is, as may be ſeen in Dr. *Deſagulier's* Tranſlation of M. *Mariotte*, and which has been confirmed by undoubted Experiments, that a Spring-head five Feet one Inch high, will raiſe the Water 5 Foot, and that conſequently the Friction that is allowed, is one Inch; and according to this Proportion the following Table is calculated.

A

A TABLE of the Heights to which Water will rise, proceeding from Reservoirs or Spring-Heads of different Heights; as also from five Foot to 100.

The Height of the Reservoir or Spring Head.		The Height to which Water will rise.	
Feet	Inches.	Feet	Inch.
5	1	5	0
10	4	10	0
15	9	15	0
24	4	20	0
27	1	25	0
33	0	30	0
39	1	35	1
45	4	40	0
51	9	45	0
58	4	50	0
65	1	55	0
72	0	60	6
79	1	65	0
86	4	70	6
93	9	75	0
101	4	80	0
109	1	85	0
117	0	90	0
125	1	95	0
133	4	100	0

It has before been obſerv'd, that the weakneſs of Water that runs a great way, is a great Deal more in Proportion to the Length it runs, than to any other Cauſe, it being found by Experiments (as the learned and ingenious Dr. *Deſaguliers* tells us) that this diminution or weakening of the Water, diminiſhes rather in Proportion to the Length it runs, than to the Friction againſt the Sides of the Pipes.

But as this Diminution is Fact (let it proceed from what Cauſe it will) and as all Motions do decreaſe in Proportion to the Spaces through which they paſs, it will be proper to endeavour after a Determination, as near as poſſibly we can, that we may come the nearer to the Truth of our Calculation, in the giving this requiſite Dependance to Water, that is to run from a Spring-Head to a Reſervoir, either in Leaden or other Pipes.

And ſince this Diminution or Stop-

Stoppage is (as all other Motions are) in a subduplicate Ratio to the respective Spaces through which it passes, let us suppose, that as Water that falls from a Reservoir of 133 Foot high, rises but to 100 Foot at a 1000 Yards Distance, and that this Diminution beginning from thence, increases gradually, suppose four Inches at the first, and so on according to the fore-mention'd Ratio, then the Account may stand thus.

A TABLE of the Diminution or Decrease of Water passing through Pipes of great Length.

Length.	Decrease.	
Yards	Feet	Inches
1000	0	4
1500	0	9
2000	1	4
2500	2	1
3000	3	0
3500	4	1
4000	5	4
4500	6	9
5000	8	4
5500	10	1
6000	12	0
6500	14	1
7000	16	4
7500	18	9
8000	21	4
8500	23	1
9000	27	0
9500	30	1
10000	33	4

By which it appears that this Diminution will be 33 Feet 4 Inches in 10000 Yards, or about five Miles and three quarters or something more.

And this seems to be the least that can be allow'd, so that if that an exact Calculation were to be made from these Rules for the Descent of Water, for the four Miles and a half in Length before-mention'd, it would come to agree pretty nearly with what I have been endeavouring to establish for a certain Rule, which will be visible from the following Example, which is summ'd up in two Lines.

Impri-

		F.	I.
Imprimis	The Friction of 25 Feet 4 Inches —	2 :	2
Secondly,	The Diminution or Decrease in passing through 8000 Yards, which is a little more than four Miles and a half.	21 :	4
	In all	23 :	6

But notwithstanding what hath been said of this Diminution or Stoppage in Pipes of Conduct, yet in large open Aqueducts, Rivers or Sewers, (where the Friction is not sensible) there will be no Occasion for this great Care in the Calculation of the Dependance of Water.

What is endeavour'd to be establish'd from these Rules is, that though Water in an open Sewer or Drain, may pass at four, five or six Inches in a Mile Fall, yet if it be to pass thro' Pipes of Conduit, you can't allow it less than five Foot Fall, and so the Aqueducts of *Rome* are, as is before observ'd.

And tho' I will not positively assert, that Water will not pass at all with a less Allowance; yet one may venutre to say it will not pass freely.

It is plain by what has been before advanc'd, that one Foot in a Mile is Inclination enough for any River, Aqueduct or the like; it being a considerable Rule in *Hydrostaticks*, that the larger the Aqueduct or Pipe of a Conduit is, the less is the Friction, which may be so enlarg'd as not to be sensible at all.

These Things being premis'd in so plain a Manner, it may be easy for a Conductor of Springs to avoid running into an Error in attempting to perform what it is impossible for him to effect. The next Thing to be proceeded upon is, the Work.

When Water is to be convey'd about 1000 Yards, and you know from the foregoing Rules how much Fall it is proper to give in a Yard, as is set down in the foregoing Example, *viz.* a quarter of an Inch, if you proceed by the Garden Level, and ten Foot Rod, which is as good a Method as any. Let your Level be a little above ten Foot long, and exactly at the ten Foot, nail on a Piece of Wood of $\frac{3}{4}$ $\frac{1}{3}$ of an Inch thick, and beginning about a Foot or two below the common Surface of the Spring, as it is in the highest and best Seasons, or exactly at the Mark, as it is at the lowest; keep that level on which the Piece of Wood is nail'd, always from the Spring, and that will give the first Dependance.

You may, if you please, turn over the Level three or four times, and drive good square Stakes down, so that they may remain some time: and if you can see any great Length, you may with boning-Staves, (with which a good Workman should never be unprovided) bone quite through

through that View; but if you are oblig'd to go winding, then you must turn your Level over and over again, and your Level ought to be so conducted, as that the Stakes may stand just upon the Brow of the natural Ground; that your Pipe may not lie within above three Foot of the Surface; or if it be an open Sewer, you may not break up above two or three Foot, nor dig above two or three Foot deep in all sideling Ground.

To effect the same by the Water or Spirit Level, you must stand at the Spring-Head, and having turn'd your Instrument on the hanging Level, or in other plainer Words, on the Hang of the Hill where the Water is to pass; let your Assistant set forwards with a ten Foot Pole or Rod in his Hand, and holding his Hand at about four or five Foot high, let him move up and down the Hill, till the Level exactly strikes the Assistant's Head; and if you can carry it strait, let this be 70, 80, 90 or 100 Yards, more or less, according to the quarter of an Inch to the Yard Fall, as is before specified; which supposing to be 80 Yards, you are to allow ten Inches lower to your Gage; take and bone in new Pins or Stakes at every 15 Foot asunder; from which Gage you are to dig your Cut three Foot deep to lay your Pipes in; or if it be a bank'd River or Sewer, you are to throw your Stuff in all sideling Ground to the lowest Side, letting this Stake be in the middle of your Cut, whether it be either of 15 or 20 Foot, either of which are sufficient in Works of this Kind.

What is to be further observ'd upon this Head, is, that you are to creep along the Side or Precipice of the Hill, if it be for an open Sewer or Drain to be made of Brick or Stone, and to be as exact as you possibly can in your Level; but if your Conveyance be of leaden, wooden or earthen Pipes, and the Springs lie so high, as that you can command any Hills that lie between it and the House or Reservoir to which you are to carry it, and can by the Rules before given be sure, you can carry the Water over them, you may go the nearest way.

Of the conducting Water by Aqueducts, Drains, &c.

Running Water conducted in Aqueducts, is certainly to be preferr'd to Water rais'd by Engines, because Repairs, which hinder the coming in of the Water, are not so often needed, and also the Water may come easier and in greater Plenty, than when it is rais'd by Engines and brought in by Pipes; besides the Expence is generally larger in doing it at first, as well as the keeping it in Order afterwards.

Vitruvius informs us, that the Ancients in order to the bringing of Water to Towns, Cities, &c. after they had taken the Level, conducted it three several Ways, by Aqueducts,

ducts, Pipes of Lead and earthen Pipes, bak'd in a Potter's Furnace.

The leaden Pipes were at least nine Foot long, and they made them of bended Sheets or Plates of Lead, of different Thicknesses, according to the Proportion of the Largeness of the Pipes; these Pipes had likewise their necessary Declination or Sloping, and if any Valley was in the way (tho' by an unnecessary Expence) they made it equal to the Level with a Wall: they likewise had many Vents to give the Water Air, and to know where to mend the Pipes, when they wanted repairing.

And these by the Description given of them, are much stronger than the Mould Pipes now made.

The Ancients (as has been before intimated) chose rather to bring their Water in large Aqueducts, that were so high, that a Man might go upright, in order as it may be suppos'd, to mend the Pipes, and had three or four kinds of Water brought from different Springs for different Uses, in different Pipes; so that the whole Structure of their Conveyances for Water, was of an immense Height, and brought at an immense Expence, which had certainly the good Effect of keeping the Water clean and pure, as it came out of the Spring; whereas Water that is brought in open Carriages, as that of the *New River* to *Islington*, and other Waters are, is subject to be rendred foul by Land Floods, and to receive a kind of muddy Taste and Tincture from the several Soils through which it passes, in those so great Distances it is usually brought.

But as these are immense Expences, and such as are scarce consistent with the Purses of any, but the greatest and most opulent Princes and States; and as such inclos'd Aqueducts with Pipes, some of them but of a moderate Size, are not likely to supply Gardens and Cities and Towns with such large Quantities of Water, which are there wanted, these open Carriages are absolutely necessary, especially where the Property of the Ground thro' which you bring them is easily to be come at; that they are to be approv'd on before inclos'd Aqueducts, both as to the Cheapness, and also as to the Quantity of Water they convey.

To all which we may add, that altho' the Water may be rendred sometimes a little thick or muddy by Land-Floods, *&c.* yet by the Influence of the Sun and open Air, it is at the same time rendred sweeter, and freed from those corroding Qualities, that often render them injurious to Man, Beasts, Plants, *&c.* all Plants thriving better by Water that is taken out of Ponds or Rivers which run gently, than out of cold Springs.

The next Thing to be considered, is the *Profile* or Dimensions of such an open Current or Course of Water; after which I shall consider the inclos'd ones of more ancient

which do indeed bring Water to any Place clearer and leſs turbid, and therefore the fitter for drinking, &c.

The *Profile* or Depth and Breadth of ſuch Carriages, may be according to the Quantity of Water you want, or according to the Supply you have, tho' it ſhould ſcarce be leſs than four or five Yards wide at the Top, and four Feet deep. that there may be Room for that Sediment, which Water naturally obtains, by running through Soils of different Qualities; beſides ſuch a Depth requiring Banks that are ſloping, to which there ought not to be allow'd leſs than one and a half or two Foot horizontal for one Foot perpendicular; leſs width than that, will not do well; but if it is deſign'd to be a navigable Channel for larger Boats, then you ought not to allow leſs than 30 or 40, as the Canals that go between Town and Town in *Holland* generally are.

I ſhall now give ſome Direction how this open Carriage or Drain ought to be made.

In the firſt Place, you ought to keep up as much as you can in the whole Ground; and by the Side of ſuch Hill or Valley that lies near you; for that no Banking can be ſuppos'd of equal Solidity and Security with ſettled Ground; alſo all Sorts of Trees muſt be clear'd away, for the Roots of old Trees will rot and let the Water out, and the Roots of young Trees will be equally injurious; in that they will by the blowing of the Wind looſen the Banks to that Degree, that much of the Water will run to waſte there: to which may be added, that rocky Ground, Fox and Rabbit Earths, are Soils not proper for ſuch Works.

If good Clay can be procured near at Hand, it is requiſite it ſhould, eſpecially where there is a Neceſſity of raiſing Banks entirely new, or for the ſtopping of Rocks, Fox or Rabbit Earths, &c. but in other Grounds, where Paſſage is through that which is whole, there will not be Occaſion for that great Care; eſpecially if your ſupply be any Thing conſiderable; but one of the chief Cares will be to cloſe your Joints well between your new and old Ground, and when you build new Banks on old Ground, you muſt not fail to go down with your new Clay or Ballaſt, two or three Foot lower than that Ground, and two or three Foot wide, and you muſt always mix your old and new Ground together with a Toothing, after the ſame Manner as Bricklayers do, who leave it for one Brick to join to another.

It is certain, that whether it be Ballaſt or ſtrong or indifferent Clay, it is very neceſſary to ram it; or to lay the *Strata* but a Foot thick at a time, or thereabouts cauſing the Labourers to tread or wheel it over keeping as exact a Slope towards the Trench, as if it were for a Garden, and it will be proper to fill all hollow Places with waſte Earth; not ſo much for ſaving or holding Water, as for giving a proper

Baſe and ſupport to the Foot of the Bank.

The inward Sides of the Slope of the Bank, ſhould alſo be well beaten with a large Hedge Stake, before they are pared with a Spade, which ought to be done. You ſhould not allow leſs than ſix or eight Inches, or a Foot in a Mile (if it can conveniently be had) Dependance; but for certain four or five Inches is abſolutely neceſſary.

The next Method of conducting *Water*, is what was us'd by the Ancients in their inclos'd Aqueducts: but this (as has been ſaid before) is ſo very expenſive, I ſhall ſay but little of it here; but refer any curious Perſons to the Writings of *Fabretti*, which may be had at ſome Bookſellers, and from him *Monſieur Montfaucon*, who has given the Draught of the famous Aqueduct of *Metz* and ſome others; nor are the Works of *Vitruvius*, *Palladio* and other Architects of *Rome*, to be paſs'd by on this Occaſion.

But to come to the Works made uſe of by the Moderns.

The firſt is that of Aqueducts made of Brick or Stone, in neither of which do the Moderns run to that Expence the Ancients did, neither making them ſo large, nor any way ſo expenſive.

A Drain of a Foot ſquare on the inſide, made with either of the two Materials, Stone or Brick (but Brick is the deareſt) the other not coſting above 10 *d.* or 12 *d.* a Yard, as a modern Hydrauliſt ſays, tho' at that Size they will convey vaſt Quantities of Water; but the greateſt Inconvenience that attends them, is that if the Water is to be convey'd a-croſs a Valley from one Hill to another, theſe Drains of Stone or Brick will not do it, and can only be us'd where the Water is to run ſtrait, or is to turn round upon a Precipice or Side of an Hill upon one Level.

Indeed wooden Troughs may be laid a-croſs Valleys ſupported with Frames of Wood; but theſe are attended with many Inconveniencies; as the Drought in Summer which will chap and tear them to Pieces; ſo that the Water will be in Danger of being loſt, or the Trough liable to be cut or broke to Pieces, by miſchievous Perſons; in all which Caſes Under-ground Conveyances in wooden, leaden or earthen Pipes are the beſt.

But wherever a Drain can be carried ſtrait (or even round) and the Declination is eaſy and gradual, there Brick or Stone Aqueducts and Conveyances are the beſt and cheapeſt; eſpecially where the Spring is large, as ſix or eight Inches Bore, which then muſt alſo be laid in very good Mortar in the Spring, and be ſuffered to dry before the Spring is turn'd into it; it muſt alſo be bedded in Clay; and when it is cover'd over at the Top (as it ought to be) with flat Stone, you muſt ram in Clay on both Sides and Top of the ſame, to prevent the iſſuing out of the Water.

But the Brick Drain is the next in Courſe: theſe cannot

well be made above six or seven Inches square in the Inside, because a good large Brick which is laid at the Bottom and Top, is not above nine Inches long, and it must lap over an Inch on each Side at the Top, and at the Bottom there must be a Stretching Brick on each Side, to support the Side Wall and Back, or rather the End. The Construction of this Drain you may see *Plate, Fig*, 4. where the Bricks are plac'd header and stretcher, in the Manner they are when made into a Drain; the middle Brick mark'd A, may be any broken Bricks.

Every Yard will take up about 75 Bricks, which at 18 *d. per* Hundred, comes to between 13 and 14 Pence, and the Lime and setting may be worth about Two Pence, and the Digging and Claying a Groat or Five Pence, in the whole about 20 Pence; and perhaps in some Countries where Materials and Workmanship are cheaper, it may be done for 16 or 18 Pence a Yard.

But there is yet another cheaper way of Brick-Drain: and that is when a Hollow or Semi-Circle of two or three Inches in Bricks, is made about four or five Inches thick, and the usual Length.

These Bricks when plac'd together, and when set in Terras or very strong Mortar, well dry'd before the Drain is us'd, is the cheapest and most durable Method of any for Conveyance of Water; about eight Bricks will do a Yard, which Bricks are worth 3 *s. per* Hundred, the eighth Part of which is 4½ *d.* and the digging and laying and Mortar, may be worth about 3 *d.* or 4 *d.* more, and this is the cheapest Method of all; but must be laid in Clay, as all other Drains and Pipes should be.

Of the several kinds of Pipes for the Conveyance of Water, whether Lead, Iron, Earth or Wood.

Vitruvius informs us that the Ancients had but two Sorts of Pipes for the Conveyance of Water; the first were made of Lead, which was of Sheets nine Foot long, and turn'd in at Top, not unlike some made in *England*, especially for Esq. *Dodington* at *Gunville* in *Dorsetshire*, by Mr. *Watts*, a Plumber of *Brackley* in *Northampton-shire*.

These Pipes are join'd together without Solder, by what are by the Workmen call'd Flankets, which are Rings made of Iron, that may be screw'd as tight as you please at the Joint; the Nose of one Pipe going into the Tail of another; and in order to keep the Water from getting out at the Joint, there are proper Bandages of Leather that close it up by the Compression of the Flankets, under which may also be put Tow made of Hemp, dipp'd either in Oil, Pitch or Tallow, which will make a close Cement to keep the Water in, and over which the said Flankets are screw'd.

These

These kind of Pipes are much preferable to those made in Moulds, because they are cast without those Flaws and Holes, which often happen in moulded Pipes; and as they are turned in at Top and burnt (as it is termed by Workmen) they are much stronger.

Nor is there that Expence in Solder (besides many other Advantages, which will be mentioned elsewhere) which is in other Pipes.

It is true, they are dearer than other Pipes are, and are chiefly fit for such as have well furnished Purses, but then they are far more durable.

But the cheapest kind of Pipes, which are now in use, is those made of Earth; for which Mr. *Edwards* of *Monmouth* has a Patent: *Vitruvius* tells us, that the *Romans* had such kinds of Pipes made of Potters Clay, two Inches thick, and joined together with Mortar mixed with Oil, and when they had a Joint to make, they made use of a Red Free-stone, which they pierced thro' to receive the two Ends of the Pipes, and to strengthen and secure them in the Nature of a Bandage.

It is related, that some of these Pipes have been found about the City of *London*, which by several Circumstances are supposed to have been laid by the *Romans*, when they inhabited this Island; but the Joints of these were secured by a Piece of Sheet-lead, which was wrapped round the Joint; some such have been said to be taken up in *Hyde-Park*, belonging to the ancient Water-works there.

These Earthen Pipes now made by the said Mr. *Edwards*, are about 3 or 4 Foot long, and not above half an Inch thick; but they are so exactly made and fitted in the Joint that no Water can come out of them.

The Price at which they are sold, is from 1 *s.* to 2 *s.* or 2 *s.* 6 *d. per* Yard, and sometimes cheaper, according as they are in Diameter; and are very useful in all such Places where they can lie free from being gone over by Carts and Coaches.

But besides what are made by Mr. *Edwards* in the Country, there are others made by Mr. *Aaron Mutchel* of *Vauxhall* for the said Patentee; these are excellently good, he having been one of the first Inventors of them.

There was a Trial of these Pipes made at the *York-Buildings*, before Dr. *Desaguliers*, and the Plumber of the Works themselves, when being fairly tried with all the Compression of Air, and that Engine could lay upon them, and without making the least Fracture, either in the Pipes or the Cement which joined the Pipes together, a general Account of which was published in the Evening Post, of *August* 1. 1728.

These Pipes are made of a Sort of Clay equal to that of which the Tiles of the Ancient *Romans* were made, are also used in the Insides of the Walls of Houses, and are affixed likewise to the Outsides of the

ſame in the manner as Lead is; even from the lowermoſt to the uppermoſt Floor; and receive and diſcharge the Water from the Roof and Gutters of ſuch Houſes, as effectually as any Pipes made of Lead or Wood, and the Price of them ſcarce amounts to one ſixth Part of thoſe of Lead, nor more than one half the Price of thoſe of Wood.

There are alſo many other Sorts of Pipes which have been uſed by the Moderns, which were, (as appears by what *Vitruvius* has written) intirely unknown to the Ancients, ſuch as thoſe of Wood, as Alder, Elm, Oak, Beech and Iron, the laſt of which are uſed in *France*, more than in any other Place) but have not, till of late, obtained in *England*.

Pipes made of Alder, are the cheapeſt of all, tho' they are not indeed the ſtrongeſt; the boreing of the Wood being not worth above 10 *d*. or 12 *d*. a Yard; but the Diameter of ſuch Pipes is generally but ſmall, about an Inch and half, and two Inches, being the utmoſt Bore it is capable of having; nor is it ſtrong enough to bear much Force; but only to conduct a ſmall Spring a ſmall Length, and upon a gentle Current.

The Pump-makers and Pipe-makers about *London*, make uſe of Fir for Pipes, where the Stream is not great, which boreing eaſy, is cheaper than that of Elm; but then on the other hand, it is not ſo ſtrong or durable as Alder Pipes are, and is only fit for Works, where neither the Riſe nor Declivity are either of them great.

Elm-pipes are much ſtronger than any of the former, and of known uſe for the Conveyance of Water, becauſe it will lie longer under Ground in the wet and Water, than any other Sort of Pipes of Wood, (Oak excepted) will.

Now theſe being generally made of ſmall Trees and Saplings, of different Diameters, they are alſo different in Prices: becauſe they will according to their Size, be either ſtronger or weaker, and of Conſequence bear either a greater or a leſſer Force, that proceeds either from the Force or Lifting of a Wheel, or the Cylindrical Weight of Water, which lies upon them, where Reſervoirs lie high; and the Reaſon that Water Works often miſcarry, is for Want of Care and Judgment in this kind of Pipes, by making the Bore larger than they ought to be, and the Outſide or Shell too thin, eſpecially in veiny crooked Trees.

Elm, ſays a modern ingenious Author, may be cut down, hewed or bored. from 8 *d*. 10 12 *d*. to 16, 18, or 20 *d*. Yard, running Timber and a 5 or 6 *d*. a Yard, boring being ſufficient Allowance.

He tells us, he has examined the Prices of Elm-pipes about *London*, and finds as before hinted, that they are according to the Thickneſs

Streng

Strength of the Pipes, which ought to be either more or leſs, according to the Weight they are to ſuſtain.

Theſe following being the Sizes that are generally uſed, the Prices, taken at a Medium, are,

		s.	d.	
2 Inch Pipe	is worth about	1	3	*per* Yard.
3 Inch Pipe		2	0	
4 Inch Pipe		2	6	
5 Inch Pipe		3	0	
6 Inch Pipe		4	6	
7 Inch Pipe		5	0	

Thoſe who make the moſt Objections againſt Elm-pipes, urge, that there is a great Waſte of Water at every Stroke of the Engine, which forces the Water, with great Violence, thro' the Pores of the Tree; but this Objection is anſwered, by the Suppoſition that it is an Eaſe to the Work, and not at all different from Nature; but rather a Relief than a Burden to the Machine, and the Paſſage of the Water in the Pipes; which in cloſer Bodies is frequently ſo wind-bound, that it won't paſs.

There is another Conveniency which attends theſe and all other Wooden-pipes; and that is, that you may at any Time, when the Pipes are wind-bound, which they often are, when they lie long in the Ground unus'd, that then you may bore a Hole at the very Place where you perceive the Stoppage to be, which is what cannot be ſo well in other Pipes which are made of Metal.

There is another Sort of Elm-pipes, which ſome ſuppoſe to be as ſtrong, if not ſtronger and more durable than the former, and theſe are ſquare Pipes made of Elm-plank.

The Boards of which thoſe Pipes are made, are generally about 10 Inches ſquare, and an Inch and 3 quarters thick; but they may, if you pleaſe, make them a Foot or 14 Inches ſquare; but then they ought to be 2 Inches, or 2 Inches and a Quarter, or 2 Inches and a half thick.

The Sides muſt be well grooved into the Bottom and Top, and the Joints well pitched or ſtuffed with Tow or Hemp, dipped into Pitch and Tar, to keep the Water from oozing out; after which they are to be banded and collared, at about 5 or 6 Feet aſunder, with Collars or Bands made of Elm Slabs or Planks, cut out of the Sides of the Elm, and this will be ſtronger and more durable than any other Bandages are, and will ſave Iron-hoops, which are expenſive. This is ſaid to be the Invention of *John Thyle Ernby*, Eſq; of *Whetham*, near *Sandy-lane*,

Wilts, in the Road to *Bath*.

A Board or Boards of 10 Inches ſquare, will when well groov'd in at Top, make a ſquare Pipe of about 4 Inches and a half, or 5 Inches ſquare, which laſt is near equal to a circular Pipe of 6 Inches Diameter.

In order to proceed in this Work, you muſt be provided with Tow or coarſe Hemp, as alſo Pitch and Tar, and dipping the Tow or Hemp into the Tar, put it into the Groove or Joint, and then let the Workmen knock the Boards together in the Groove, with all the Might and Strength they have; the Security of the Water in the Pipes conſiſting in the Cloſeneſs of this Joint.

When this has been done, then the Collar or Bandage is to be put on at each Joint, the Boards being about 9 or 10 Foot long, and another Collar in the Middle; putting the ſmall End of one (ſo made as is done in Elm-pipes which are ſo bored) into the great End of the other.

The Conveniencies of this Sort of Conveyance for Water, are, that it is ſtronger, and alſo may be made 5, 6 or 7 Inches ſquare, which will carry more Water than bored Elm-pipes of the ſame Diameter.

In the next Place, there is leſs Depopulation and Waſte in cutting (a few large Elms at full Growth, being ſufficient for this Purpoſe) whereas when they are cut down ſmall, there is great Waſte made; and in the laſt Place, it being all Heart, it will not be ſo ſubject to break or burſt as Elm bored will.

Here follows the Expence of 330 Yards running, perform'd in the County of *Wilts*, by Mr. *Switzer*.

	l.	*s.*	*d.*
For 20 Tun of Timber at 30 *s. per* Tun	30	00	00
Felling and hewing of *Ditto*, at 8 *s. per* Tun	08	00	00
For Workmanſhip 330 Yards, at 4 *d. per* Yard.	05	10	00
For Nails, Tar, Tow, or Hemp, Banding, Collaring, and laying included at 3 *d. per* Yard.	04	02	06
	47	12	06

By which it appears that the whole 330 Yards comes to 47 *l.* 12 *s.* 6 *d.* which being reduced into Shillings, Pence and Farthings, and divided by 330 Yards, it comes to about 2 *s.* 10 *d.* a Yard; whereas Leaden-pipes of ſuch Dimenſion would coſt at leaſt 20 *d.* a Yard, and bored Elm, five or ſix Shillings.

But ſuppoſing the Workmanſhip (as it is) too little by 2 *d.* a Yard, it will be vaſtly cheaper than either Lead or Wood.

Another

Another Sort of Wooden-pipes are made of Beech, which being of a more firm and solid Contexture, and not so porous as either Elm or Oak, will lie under Ground longer than either of them, as may be seen in all Mill-work, in which this Wood is much used; but like many other Woods, has an Inconveniency attending it, that it bores pretty hard, is brittle, and not so tough grain'd as Elm or Oak is; besides the Boughs don't run in the general so strait as Elm does, and therefore the Shell of it ought to be very thick, not less than five or six Inches to keep it from bursting; and for that reason the Bulk or Dimensions of it ought to be 12 or 14 Inches Diameter, one with another, when you may venture at a Pipe of two or three Inches bore, and tho' it is something difficult to bore, yet the Water will be less subject to ooze out, than at any of the others, Oak it self not excepted.

These Sort of Pipes, the Property of the Wood, digging the Trench, boring, laying, claying and banding, will be worth 3 *s.* or 3 *s.* 6 *d. per* Yard, for a Bore of 4 Inches, and so on proportionably less, as the Wood or the Bore is less: but then it must be observed, that it is the nearest the Goodness of Lead of any Thing that is a 4 Inch Pipe, which of Lead will cost 15 or 16 *s.* as will be made out anon.

The very last kind of Wooden Pipe is Oak, which indeed is very strong, and lasts a great while, there being some Trees of that kind which were dug out of the Foundation of *Blenheim* Bridge, (as Mr. *Switzer* says, when he was Supervisor there) that were, tho' as black as Ebony, yet as sound as *Brazil* it self, and might in all Probability have no other Date than that of the Deluge it self. But as the Limbs are generally crooked, and that all the young Bodies, together with the whole Timber it self, is too good for those Purposes, there is no need to say any more of it upon this Head.

The next Sort of Pipes to be spoken of, are those made of Potters Earth; there are at least 2 kinds of these; they are of two Thicknesses in the Shell, the first being the most in use in the Country, is not above the Thickness of two Crown Pieces at the most; but this is so thin, it is only fit to convey Water a little Way, where the Fall is not great. These are said to be bought in many Places in the West, for 6 *d.* a Yard.

The other is the new invented ones already spoken of, which nevertheless are not above half an Inch thick in the Shell; the Potter who makes them being of Opinion,, that a greater Thickness would be entirely useless; or perhaps the true Reason may be, they can't burn them so well.

These indeed are excellent Pipes well glaz'd on the Inside, as they ought to be, to keep Water sweet; and how they will perform in Force-work, an

Account has already been given.

Indeed some Persons say, there is indeed a Weed apt to grow at the Place, where they are jointed together, the Fibres of which are apt to choak the Pipe; but this, if true, may certainly be prevented; by putting on a thin Bandage of Lead round the Joint, or a Collar of Stone and Wood to strengthen them, you may prevent that Mischief.

The Manner of mending them, when broke, has been another Objection, that has been made against them; for if the Joint be made of such a Cement, as that the Pipe will break any where, rather than there, it does not seem easy to say, how they will be mended. But in Answer to this. the Joints of those Pipes made at *Vauxhall*, will shoot so close together, that there is little Occasion for any Cement at all; but if they do, Tow dipped in Pitch and Tar, or any other Cement of that kind, will effectually stop it, at least the Loss of Water will not be great, where the supply is any thing large, and then they may be uncollared and mended at pleasure.

There is one Thing however to be minded; that is, that they will not serve in High-ways and Streets, where Carriages and Coaches are to cross them; but on all other Accounts they are not only cheap Conveyances, but also excellent Pipes.

Of all Sorts of Pipes for the Conveyance of Water, that of Lead is preferable (especially those which are made of Sheet-lead and burnt at Top, if it were not for the Expence, because they are more pliable to lay up and down Hill, and may be also more easily and firmly jointed to one another; or, as durable as any, and if well cast, of a much closer Contexture.

In Pipes of Conduct, and where Water is carried a great Way, these Pipes ought to be 6 or 7 Inches Diameter, but must not be less than 4 or 5; because in Pipes of that Size, there is less Friction and Windboundness than in those that are smaller, and consequently the Water will flow the better, and more regularly rise up to the Height of its first Head, and also in greater Quantities.

It must indeed be own'd, that a Pipe of Conduct of so large a Dimension of 6 or 7 Inches, is such an Expence as few Gentlemen, or even Noblemen will be willing to be at, in very great Lengths, where the Expence is almost immense; Pipes of that kind, without a Shell of Thickness proportionable to it, being worth from 25 to 40 *s.* a Yard, according to the Height of the Reservoir, or the Force of the Water they are to sustain.

Therefore a Pipe of Conduct of the cheapest Kind, must be at least 4 Inches and a half, or 5 Inches Diameter, and such will not cost less than 16 or 18 *s.* a Yard. And for this Reason, in many Places, they have reduced their Pipes of Conduct to three Inches Diameter, which is indeed too little. This

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it is true, reduces the Expence to 10 or 12 *s. per* Yard, according as the Price of Lead is.

Suppoſe Lead, caſting of Pipes, and all is reckoned at 22 *s. per* Hundred Weight, the Calculation may be as follows.

To a Pipe of 3 Inches Bore, is uſually allowed 45 Pounds a Yard; and this is worth about 9 or 10 *s. per* Yard, when Lead is worth from 22 to 45 *s. per* Hundred, allowing for Waſte.

To a Pipe of 22 Inches, 3 Quarters, 40 Pounds is allowed, which is worth between 8 and 9 *s. per* Yard.

To a Pipe of two Inches and a half, 36 Pounds is allowed, and then it is worth about 7 or 8 *s. per* Yard; but it would be proper to add 5 Pounds more to every Yard, tho' it does add ſomething to the Expence.

To a Pipe of two Inches Diameter, there is allowed uſually 30 Pound of Lead, and then it is worth about 6 *s. per* Yard.

But of all the Pipes of Lead, of what Size ſoever, thoſe that are joined by Flankets (as has been already mentioned) are the beſt; becauſe they may be eaſily taken up, and ſcowred or cleanſed, whenever there is Occaſion.

Becauſe as M. *Mariotte* obſerves, there is, even in the fineſt Water, a Sediment, which will in Time petrify, incruſtate and grow hard, and will ſtop up the Pipe, which can never be cleanſed again, where the Pipes are ſoldered together at the Joints with Solder, as Pipes generally are. And this (among ſome others) is one of the Inconveniencies which attend all Water-works, and is the Occaſion of their being ſpoiled.

Notwithſtanding ſomething has been already ſaid, concerning the Lead proper to be allowed to Pipes in general, according to the Proportion or Diameter of their Holes: but when Reſervatories are very high, or Water is raiſed by an Engine to great Heights, or carried to great Diſtances, there Pipes of Conduct are in great Danger of being often broke, if the Shell is not thick enough, eſpecially up and down Hills, and through deep Vallies, and it would render a perſon very uneaſy, after he has been at a great Expence, if his Pipes ſhould happen to burſt thro' the Defect of the Solder, or the Weakneſs of the Pipes. At the ſame time, Care ſhould be alſo taken, on the other hand, not to make them thicker than is abſolutely neceſſary, ſince a ſmall Addition in long Lengths would greatly enhance the Price.

But it is requiſite, that we ſhould know by Experience (as well as from what M. *Mariotte* and others have delivered upon this Head) that the Thickneſs of the Metal or Shell of the Pipes, be increas'd or diminiſhed in Proportion to their Diameters, the Heights of the Reſervoirs from which the Water falls, or the Height to which it is to be raiſed by Engines; and laſt of all, the

Lengths or Diſtances, which Water is to be carried: All which adds to its cylindrical Weight; and of Conſequence the greateſt Thickneſs of Metal in the Pipes.

As for Example, according to Mr. *Mariotte*, when a Reſervoir is 60 Foot high, and the Pipe 3 Inches Diameter, the Metal muſt be half an Inch in Thickneſs, which is the 24th Part of a Foot; but as it is not to be doubted, but that M. *Mariotte* means Copper, which is harder, ſtronger and of a cloſer Contexture than Lead, therefore 3 or 4 whole Lines, which is one fourth or third Part of an Inch, will be Thickneſs little enough, and for a Reſervoir 100 or 120 Foot high, a whole Inch, becauſe of its great Height.

If the Pipes are both wider and higher, then the two Proportions muſt be alſo obſerv'd: Thus,

If a Pipe comes from a Height of 60 Foot, and the Diameter be 6 or 8 Inches, you muſt take the half Line in Copper, according to M. *Mariotte*, or rather 3 Lines or the Quarter of an Inch in Lead, becauſe of its Height of 60 Foot; and for the Thickneſs, you muſt work by the Rule of Three, ſaying,

If 9, the Square of 3 Inches, require 3 Lines thick of Metal, What will 36 the Square of 6 Inches require?

EXAMPLE.

As 9 is to 3, ſo is 36 to a fourth Number required.

3

———

9)108(12 Lines is the Anſwer.

18

———

So that a Pipe of 6 Inches Diameter, when it comes from a Reſervoir 60 Foot high, ſhould be 12 Lines, or one Inch thick, near, or according to which, the following Table is calculatd.

But firſt of all there is another Thing to be determined, and that is the Diameter of the Ajutages.

The Author of the Theory and Practice of Gardening, tells us, that it may be taken for a certain Rule, that the Bore of the Ajutage ought to be four Times leſs than the Bore or Diameter of the Pipe of Conduct; that is, it ſhould be in a quadruple Proportion to it; ſo that the Column of Water may be proportionable, and the Quickneſs of the Motion in the Pipes may be equal.

And beſides (as has been already obſerved) there is too great a Friction or Wear in ſmall Pipes, when the Quill is too big, and in the Bore of ſmall Quills, when Pipes are too large: All theſe Things do alſo depend upon Calculations of

of this Kind, which will be neceſſarily included in a Table, where the Diameter of Pipes of Conduct, Thickneſs of Metal, &c. are contained.

Now the Calculations of M. *Mariotte* being ſuppoſed to be of Copper, Lead, not being ſo much uſed in *France*, as it is in *England*, it has been thought proper, by an ingenious modern Author, to pitch upon a Pattern of a Leaden one, which ſhould determine all that is required on this Subject; which he tells us he has done from a Pattern, which, by all good Judges, is accounted an excellent one.

The Pipe is four Inches Diameter, which is generally ſuppoſed a good Pipe of Conduct (tho' in ſome Caſes more may be requiſite) and about equal to the Expence that moſt Noblemen and Gentlemen may be willing to be at.

The Thickneſs of the Metal which is of Lead, is 6 Lines or half an Inch, to regulate then the Thickneſs of other Metal to it, ſay as before:

If 16, the Square of 4 Inches, requires 6 Lines; how much does 36, the Square of 6, require?

EXAMPLE.

16 : 6 : : 36
6

16)216(13½ the Anſwer.
56

8

By rejecting the Fraction, it appears, that the Thickneſs of the Metal requires to be 13 Lines, or one Inch one Twelfth; and upon this Foot the ſaid Author has formed the Column concerning the Thickneſs of Metal in Pipes, which ſeems to be (without any conſiderable Variation) agreeable to Truth, which expreſſes alſo the Height that the Water coming from the Reſervoir will riſe. The following is the Table.

The

The Height of the Reservoir.		The Diameter of the Pipes.		The Thickness of the Metal.		The Diameters of the Ajutages.		The Height the Water will rise to.	
Feet.	Inch.	Inches.	Lines.	Lines.		Lines.	Parts.	Feet.	Inch.
100	0	7	00	15 ½	16	12 or	15	80	00
86	4	6	00	14	00	12	14	70	00
72	0	5 ½	00	12	13	10	12	60	00
58	4	5	00	9	9	8	10	50	00
45	4	4 ¼	00	7 ½	8	7	08	40	00
33	0	3	00	6 ½	7	7	00	30	00
21	4	2 ½	00	5 ½	6	6 ½	00	20	00
15	9	2 ¼	00	4	5	6	00	15	00
10	4	0	25	3 ½	4	5	00	10	00
5	1	0	22	3	3½	4	00	5	00

This may ſuffice as to the Diameter of Pipes of Conduct, the Thickneſs of the Metal, the Diameter of the Ajutages, &c. as are, or ought to be proportionable the one to the other.

But if any Perſon has a mind to have his Pipes of Conduct larger than any above mentioned, he may; this Table being chiefly calculated for all proportionable Heights.

Iron-Pipes now growing into great Uſe, and being, in reſpect to their Cheapneſs, the beſt Pipes, thoſe of Clay excepted, which are now made, eſpecially, if the Metal is well proportioned and melted, I ſhall add concerning them.

That it will be no great Advantage to caſt them very ſmall; the beſt Sizes being from 7 or 8 to 5, 4 or 3 Inches Diameter, the firſt of which will coſt abou[t] 20 *s.* a Yard, which is muc[h] about half the Price of Lea[d] and the leſſer from 16, to 1[5] 14, 12 or 10 *s. per* Yard, a[c]cording as they are greater [or] ſmaller in Bulk or Diameter.

Theſe Iron-Pipes are t[he] moſt durable of any yet me[n]tioned; they are caſt in Lengt[hs] of 3 or 6 Feet, and ſometim[es] 9, and are joined together [by] Flanckets, as may be ſeen [at] the Water Works at *Lond[on]* Bridge. Theſe, if well mad[e] will laſt, as one may ſay, [for] ever.

Theſe Iron-Pipes are to [be] had of Mr. *Bowen*, at his Fou[n]dery, near *Marigold-Stai[rs]* *Southwark.*

As to the Method of making Reservoirs, Basons, &c. their Construction, Extent, Depth, and other Dimensions, take the following Directions.

Vitruvius informs us, that the Ancients, in making their Wells and Cisterns, to receive Rain and other Water, used to make them under Ground, and to a very large Extent; and Walls were built on the Sides and Bottom with Mortar made of strong Lime, Sand, and Pebbles, well beaten together; claying, as we may suppose, not being so well known to them, or to be had in such Quantities, as now it is.

Of these they made several, one after another, thro' which the Water was to pass, to the End, that the Sediment might remain (if any there was) in the first and second, and so that when the Water was arrived at the last, it might be clear. They likewise put Salt into their Cistern Water to make it more subtile.

In this Manner were the remarkable Cisterns of *Roselayn* made, *viz.* with no other Materials, as has been already intimated, than Gravel and small Pebbles consolidated together, by a strong tenacious Cement, not improbably, such as Terras-mortar, or the like.

But a better and cheaper Way, is to have the Hills of the finest Sand, that can be conveniently procured, such as in its own Nature, is not subject to be dirty.

When the Water comes in, then let it be at one End, having 3 or 4 of these Sand-banks lying across the Reservoir, give the Water Time to filtre thro', and let the Pipe which is to supply the Fountain lie at the farther End. So you may expect to have your Water clear; and these Sand-Banks should lie, and be above the Surface of the Water when it is at the highest of all.

Nor can too great Care be taken in making those useful Reservatories, as daily Experience shews, especially if it be upon a dry Gravel, or sandy Bank, and is to lie above Ground, as is evident from that very handsome one behind his Grace the Duke of *Chandois*'s intended Building near *Cavendish* Square, where the Expence of making and fitting it, has doubtless been very great.

As to the Form in which these Reservoirs or Basons are made, it is of no great Consequence, whether it be a perfect Square or an oblong (which are the best Figures) or any other; and as to their Extent, that ought to be according to the Quantity of Water that is required, 100, 150 or 200 Foot square, being sufficient in most Cases; tho' for large Cities, Towns, &c. 300, 400 or 500 is little enough.

But the deeper they are the better, contrary to the Practice of some Persons, who have made them not more than 3 or 4 Foot deep, when they ought rather to have been from 7 or 8, to 10 or 12 Foot deep, that the

the Water may settle the better.

The Bottom also ought to be filled, 2 or 3 Foot high, with large Gravel Pebbles, by which Means the Sediment will have Room to lodge and settle therein; and this Bottom should be well clayed, and lie lower by 3 or 4 Foot than the Bottom of the Aqueduct, which brings the Water in for the Purposes before mentioned.

If the Reservoir be but small, as 15 or 20 Foot over, Mr. *Switzer* advises to make it in the Form of a Conoid; because by this Shape, the Pressure of the Water on the Pipe of Conduct will be regular and uniform from the Beginning to the End of the going out of the Water.

It is by this conoidal Form, that *Archimedes* in some Propositions in his two Books, *De insidentibus Humido*, demonstrates the Gravitation or Pressure of Fluids one upon another, which was also followed by *Galileo*, *Torricelli*, and others.

To the same Purpose also, *Mariotte* in his Rules for the measuring of spouting Waters, through Ajutages of different Bores, in his Treatise of *Hydrostaticks*, sets down a very curious Problem. This Problem is to find a Vessel of such a Figure, that being pierced at the Bottom with a small Hole, when the Vessel is small, but larger as a Vessel or Reservoir is larger, that the Water should go out, its upper Surface descending from equal Heights, in equal Times. This he says, *Torricelli* has not undertaken to resolve.

Let it be a conoidal Figure, as *Fig.* 1. in the following Plate, where B L is to B N, as the Square squared of N O, and B N to B H, as the Square squared of N O, to the Square squared of H K, and so on: the Water will descend from A D C, in an uniform manner, till it come to the Hole at B.

For let B P be the Mean Proportional betwixt B D and B H since the Square squared of K H and of D C are to each other, as the Heights B H, B D, the Squares of H K, D C will be in a subduplicate Ratio of B H to B D, or as the Heights B P, B D.

But the Velocity of the Water that goes out at B, by reason of the Pressure of the Height B H in a subduplicate Ratio of B D to B H; that is to say, as B P to B D: Therefore the Velocity of the Water descending from H, is to the Velocity of the Water descending from D, as the Square of H K to the Square of D C: but the circular Surface of Water at H, is to the circular Surface of the Water at D, as the Square of H K to the Square of D C; therefore they will descend and run out, one as fast as the other: and if the Surface A D C runs out in a second, the Surface G H K will run out in a second likewise, since the Quantities are as the Velocities.

The same Thing will happen to the other Surfaces at E and F, &c. But the Hole must in

all

all minute Cases causes be very small, and that no considerable Acceleration may be made, and that the Water may not go throughout the Hole sensibly; but in a Proportion to the Weight.

A Vessel of this Model, says the ingenious M. *Mariotte*, may serve for a *Clepsydra*, or Water Clock.

To this it may be added, saith an Ingenious Author, For any Reservoir for supplying and playing Fountains, or any other Water Works, in Gardens, or for the regular Distribution of Water for the Use of any City or Town, and as still the more useful, and proper to be made, when the Spring rises near the Place where the Water is to be used, as does that of *Long-Leat* in *Wiltshire*, the Seat of the Right Honourable the Lord Viscount *Weymouth*, and other Places.

The Section or Profile of a Reservoir being thus set down, pertaining as it does only to those which are narrow and deep, as all Reservoirs must be, which are made on the Side of a Hill, and near a Spring, it will be requisite to inform the Reader, that the Structure of such Reservoir or Cistern be of Stone or Brick, since there is no working of Clay, to stand in so perpendicular a Manner, as the Figure describes.

But when Reservoirs are made of that great Extent, which they often are, this Profile or Section can be of no great use, nor can the Figure of it be followed.

I shall therefore lay down a short Account of those Rules that are necessary to be observed in the Profile and Disposition of Reservoirs, that are made of Clay, and the Methods of digging, picking, cleansing, beating or ramming of that useful Material.

The Steps then on each Side, and on the Ends of any Reservoir, if the same be made of Clay, which is the cheapest Material by much, with which Reservoirs or Ponds are usually made, ought to be at least 3 Foot horizontal to one Foot perpendicular, that they may stand well, and not be apt to moulder: so that if a Reservoir be made 7 or 8 Foot deep, which ought to be done in Works of this Kind, the Basis of the Slope ought to be 28, 30 or 32 Feet; the Profile or Section of which see *Fig.* 2. and the Banks ought to be cleared of all Trees and other Incumberances which are apt to tear the Banks by their Rocking, by reason of the blowing of Winds.

The most proper Season for digging of Clay, and making Reservoirs, and other Water-works of this kind, is generally reckoned to be about *Michaelmas*, after the Falling of the first Rains; for then the Clay will work well; and the cool Season is coming on, and in such Manner, that you may expect the Rains will fill your Work, in case a Supply should be precarious.

But the Winter or Spring, or indeed any other Part of the Year will do as well, provided the

the Clay be used immediately after it has been digged; and that you have a River, a strong Spring, or some good Engine to fill it; but you must be sure to avoid Frosts, and the dry cutting Winds of *March*, which are more injurious to new Ponds, than any other Variation or Change of Weather does.

When the Shape of the Reservoir or Pond has been made, then the Clay is to be dug, and immediately used, otherwise you will be obliged to water it, which will spoil it; also all large Stones, Sand Holes, and Veins should be carefully picked out; and all such Parts as any way degenerate from the general Mass or Vein of the Clay that is digged, should be thrown out.

The strong reddish or yellowish Clays are accounted the best, tho' there are also white and blue Clays, which are as tenacious as any of the rest; tho' perhaps they are not so ductile, and do not work so well.

The Pond-men in the West-country chuse that Sort of Clay that has some small Quantities of small Pebbles or Gravel in it, because they say it rams better; there is also this Conveniency in them, that they lying upon the Chalk, will contract the Sediment and Slime, which comes with the Water, and render it more pure and clear.

Clays often run in Veins; but if it be dug out of Pits, where it lies deep; generally the deeper you go, the better and stronger the Clay is.

Having found and dug a good Clay, carry it to the Place where it is to be used, and use it immediately, before it has been hardened by the Sun and Air, so that it won't work; but if you have not immediate Occasion for it, cover it with long moist Horse-dung, or wet Hay or Thatch, and when it has been brought to the Place, where it is to be used, begin in the very Centre or Middle of the Bottom of the Pond, where it must be laid thicker than ordinary; and then you must work every Way from it, treading and beating it well with Instruments, as you proceed: As to the Thickness of the Layer of Clay, there is no certain one agreed upon; some laying it a Foot, others a Foot and a half, and some thicker; and they lay it not all at once, but in two distinct Layers of about 6 or 8 Inches thick.

Having begun (as has been directed in the very Centre or Middle of the Reservoir, and laid it there about 6 or 8 Inches thick; the Horse-heads or large Spits of Clay may be thrown together, just as they are dug out of the Pit, only picking out the large Stones, or any Veins of Sand that are in it, and work it well together with a large heavy Beater or Beetle, such an one as is used in cleaving of Wood.

Finish a Yard or two at a Time in this Manner; which being done, you must use another Flat Beater, such as Greese, is

is beaten with; or rather (which is better) have one made in the Form of a hard Brush, wherewith Maid-Servants rub their Rooms: but the Handle of it must be stronger, and in the Block there should be fix'd, 4, 5 or 6 strong Iron Teeth; which will cut or scratch cross the Joints, and prevent any open Chasm or Crack that would otherwise be there.

When this has been done, take such a Rammer as is us'd by Paviours (tho' it need not be quite so heavy) and smooth it over.

After you have done this, it will be proper to lay a little long Dung, Hay or Thatch on it, to keep the Clay from cracking till you lay on the second Coat.

Having thus finish'd the first Coat, after the Manner before directed, strew some slak'd Lime over it; which will not only corroborate and cause the Clay to grow hard and dry, and as it were, almost impenetrable; but it will also (as the West-Country Pond-makers say) hinder the Worms from working into the Clay.

Thus having finish'd the first Coat or Layer of Clay; begin the second of the same Thickness as you did the first, working it after the same Manner, every way from the Centre, taking Care especially to break, join or close the Clay well, by Means of your toothed or spiked Instrument beforementioned; and there will be this Advantage in doing it over again, that if there should be the least Crack or Perforation in the first Layer, the second coming over it, will fill it up, and mend every Place that may have happen'd to be defective.

Having finish'd the second Coat, as before, mix some Lime and Chalk together, and ram it on three or four Inches thick, which incorporating into the Clay, will render it as it were one solid Body, which, if there be Occasion, may be pitch'd with Flint Stones; that is, if Cattle are allow'd to go to it to drink.

All Reservoirs, if not wharf'd with Wood, Brick or Stone, (which is very expensive) ought to be pitched a Foot or two below the High-Water Mark, to prevent the Clay from being wash'd away on the Sides of the Reservoir; as also the working of Moles, Mice and other Vermin who spoil the Banks.

Some will lay a third Layer or Coat of Clay over the other two, and of the same Thickness, *viz.* six or eight Inches: This Method is not to be disapprov'd of (if Persons are willing to be at the Expence) and is also necessary in Grounds that are of a dry, gravelly, husky Nature; one of which Kind in *Essex*, the Water ran out so fast till the Earth was sated, that an Engine which was employ'd three Days and Nights could scarce keep it full; so that three times Claying is not much more expensive, but is very much securer.

The digging and claying of a Reservoir or Canal twice, is

 said

said to be worth 12*d.* a Yard superficial; and if it were to be clay'd a third time, it would not be above 3*d.* a Yard more, but then all the Clay must be brought to the Place; but some Head West Country Pond-men have had 18*d.* *per* Yard for twice claying.

It has been observ'd that the Pond-men in the West of *England*, do not pitch their Fish-Ponds so much as they were won't to do; but lay Chalk upon the Clay, six or eight Inches thick; which is better than pitching for all Sorts of Fish.

WATER WHEEL, an Engine for raising *Water* in great Quantity out of a deep *Well.*

It is of different Makes; some use a large one for Man or Beast to walk in for that Purpose, others a double Wheel with Logs, which makes it draw easier than the ordinary single Wheel; tho' this is not so good a way as the double Wheel with Lines; the Line at the Hand being small and very long: but there cannot be a more expeditious way than to make a larger Wheel at the End of the *Windlass*, that may be two or three times the Diameter of the *Windlass*, on which a smaller or a larger Rope may be wound, than that which raises the Bucket; so that when the Bucket is in the Well, the same Rope is all of it wound on the greater Wheel, the End of which may be taken on the Shoulder, and the Man may walk or run forwards, till the Bucket is drawn up; in which Operation the Bucket may hold 20 or 30 Gallons, and yet be drawn up with more Ease than one of seven or eight in the ordinary way; and besides the Bucket may have a round Hole in the Bottom, with a Cover fitted to it like the Sucker of a Pump, that when the Bucket rests on the Water, the Hole may open and the Bucket fill, and as soon as it is rais'd, the Cover stops it immediately, which prevents it from diving.

Teeth may also be made on the outer Wheel, with a wooden Ledge, so falling upon it, that as the Man moves forward, it may stop; but when the Bucket is as high as is intended, then the Ledge bearing against the Teeth, stops the Bucket until you come to it, after the Manner of the Wheel of a *Watch*, *Clock* or *Jack*.

To which may be added, that when the Bucket is up, a Receiver may be at Hand, and a moveable Trough to slip under the Bucket; that when the Cover is rais'd by a small Cord, fastened to it on the Inside, the Water may be receiv'd thereby: by this Means many Tuns of Water may be drawn up in a short Time.

WEATHER BOARDING [in *Carpentry*] signifies the nailing up of Boards against a Wall.

Sometimes 'tis us'd to signify the Boards themselves, when nail'd up.

This Work is usually done with Feather-edg'd Boards: In plain Work they usually nail


Plate XXXII
B
Fig
G


Plate XXXII
32
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.

the thick Edge of one Board, an Inch or an Inch and a half over the thin Edge of another; but if the Work is to be something extraordinary; they set an O G on the thick Edge of every Board.

The Price] The Price of *Plain Weather Boarding* (*viz.* the fitting and nailing up the Boards) is from 8 *d.* to 12 *d.* the Square, according to the Length and Breadth of the Boards, and Conveniency of the Place.

But if the lower, (*viz.* the thicker) Edge of the Boards be wrought with an O G it may be worth 18 *d. per* Square, for the Workmanship only.

If the Workman find the Materials (*i.e.* Boards and Nails) it may be worth 12 or 13 *s. per* Square, or about 1 *d.* ½ *per* Foot.

WEATHER TILEING is the covering the upright Sides of Houses with Tiles.

The Price.] *Weather Tileing* is done in some Places at the same Price as other *Plain Tileing*; but in other Places they have more in Consideration of Scaffolding: for some Workmen say they have 4 *s. per* Square for Workmanship only.

WEDGE. The Power of this Engine is put in Motion by Percussion or striking; it is therefore to be first observ'd That the Centre of Percussion is that Point by which a Body, as a Beetle, &c. in its Motion strikes with its greater Force another Body (as a Wedge) which opposes its Motion.

That is, the Point A in the middle of the Wedge A D, just under the Centre of Gravity N, of the Beetle B A is the Centre of Percussion, and the Line N A is its Line of Direction. See *Plate*, *Fig.* 1.

And it is to be observ'd here, as before, in the preceeding Machines, that the greatest Force or Blow is given, when it falls perpendicularly upon the Wedge; on which the Stroke or Force is apply'd; for 'tis evident, that if the Stroke or Force is applied at oblique Angles, as the Beetle E F, the Line of Direction of the Force N B, will not be parallel to the Central Line of the Wedge A I; nor will the Line of Direction of the Force E N, be parallel to the upper Surface of the Wedge, as in the former.

Now, seeing that the Line of Direction N B is contrary to the Line of Direction N A D, 'tis evident that the Beetle F E apply'd at oblique Angles, has less Force on the Wedge I, than when apply'd at Right Angles, as the Beetle B A on the Wedge C.

To understand the Power of the Wedge, one of the inclining Sides is to be considered as a horizontal Plain, and we must imagine, that by the Help of the inclin'd Surface, a Power shall raise a Weight, which without this Machine, could not so much as sustain or bear it up.

1. Let the Triangle D B C, right-angled at B, represent a Wedge, wherein let the angular Point D, represent the Point or Edge, and the Perpendicular

BC, the Head at which the Power is to be apply'd.

For the better understanding the Power of this Engine, the Length of its Base, as DB, and Height BC must be given or known, that thereby their Proportions to one another, may be known. See *Plate*, *Fig*. 2.

For the Analogy or Proportion is this:

As the Height of the Wedge
Is to the Base of the Wedge,
So is the Power apply'd at its Centre of Percussion, to the Weight that the Wedge will sustain or bear up.

Which will immediately be demonstrated; but 'tis to be noted, that in all Calculations of this Kind, the Surfaces of the horizontal Plane, whereon the Wedge slides, the Surfaces of the Wedge, the Surface of the Body to be rais'd, are suppos'd to be so very smooth, as to slide without Obstruction or Difficulty.

Again it must also be suppos'd, that the Weight E be hindred from going to A, by the perpendicular Plane HIK; which however is to be suppos'd not to hinder the Wedge DCB from sliding along the horizontal Plane AB, as 'tis driven or forc'd from B towards the Power apply'd at B, whose Line of Direction is parallel to the Horizon.

Now if the Power apply'd at B, drives or forces the Wedge CDB regularly from B towards A, upon the horizontal Plane AB, it will cause the Weight E to ascend by so regular a Motion, that its Centre of Gravity E will by its Ascension generate the Right-Line FD, perpendicular to the Horizon; so that when the Point B shall be come to D, the Point C to E, and the Point D to G, the whole Wedge CDB shall have chang'd its Place to EDG, and the Body E will be rais'd the whole Height of CB, the perpendicular Height of the Wedge.

Now if BB the Base, be = twice BC the Height, then the Power shall have mov'd the Line DB its whole Length, which is = twice CB, and therefore the Power to the Weight will be, as 1 is to 2: That is,

As the Height CB 1,
Is to the Base DB 2:
So is the Power of one Pound apply'd by Percussion at B, to two Pound, the Weight of the Body E, rais'd to F.

From hence it follows, that the more acute the Wedge is, the greater will its Effect be: because GD the Velocity of the Power, will be great in Comparison of DF, the Velocity of the Weight.

When the Wedge is apply'd to cleave a Body, as ABCD, the Planes EFOI and GFOH, which make up the Wedge, being more inclin'd to each other, the Parts EG will therefore slide more easily.

If the Plane EFOI be considered as a horizontal Plane, the other Plane GFOH will be an inclining Plane; wherefore the Resistance of the upper Part of the Body ABDC, which is to be disunited from the lower, may be accounted as a Weight whose Line of Direction

rection is perpendicular to the lower or horizontal Part, and then a Power apply'd as aforesaid with an additional Power for the Roughness of the Body, when irregular will have the Effect desired. See *Plate*, *Fig.* 4.

It is also to be observ'd, that altho' the Power of a Blow or Stroke, is equal to a certain Weight, yet if that Weight is laid gently upon a Wedge, it will not have the same Effect in forcing it into a hard Body, as when the same Weight is communicated to it by a Blow.

And it is also to be observ'd, that the Effect of Percussion will be the greater in Proportion as the Percutient or striking Body is heavier and swifter: that is to say, the heavier the Body is, with which the Stroke is given, the greater Effect it will have.

Therefore,

If with a Body of ten Pound Weight, a Stroke be given in one Second of Time, that will raise 20 Pound Weight, the same Body being struck in like Manner, will double the Force; that is, in half a Second of Time, it will raise 40 Pound Weight, which is double to the former.

Hence it appears, that the Power of Percussion is proportionable to the Velocity of the Stroke.

If any shall object that they do not conceive how the Wedge is of any great Use in raising heavy Bodies, since there seems to be a resisting Plane necessary as K H I, which in many Cases cannot be practicable, and therefore of Consequence, the Wedge seems to be of little Use.

But such Persons are mistaken; for an heavy Body may be rais'd without a Plane perpendicular to resist it.

As for Example, Suppose the Body E is to be rais'd to the Height of the Wedge F G, it is plain that if against the Wedge F D G, you place another Wedge, as A B D equal thereto, so as to work close to each others Sides, and each Wedge being driven with equal Force, will raise the Body E the Height required. See *Plate*, *Fig.* 4.

And as has been said before, the longer or more acute the Angle of the Wedge is, the easier the Weight will be rais'd. This has been already prov'd, and therefore I shall not repeat it.

It is likewise to be observ'd in this, as has been observ'd of other Mechanical Powers; that as much as is gain'd in Force, is lost in Space and Time, because the more acute a Wedge is made, the greater Length it must be to be equal in Height to another Wedge, whose Angle is less acute, or rather, whose Angle contains a greater Number of Degrees.

That is, the Wedge A C D, whose Line A D C is less than the Line B D E, must be longer than the Wedge B D E, to be equal in Height thereto, for was the Wedge A D C to be no longer than the Wedge B D E, that is, G F D E, then it could

not raise the Body higher than F. See *Plate*, *Fig*. 5.

Hence 'tis evident that DF must be continued to A, and DG to C, whereby it will raise the Body to the Height requir'd.

And since that tho' the Wedge ADC will move with less Force than the Wedge BDE, yet it requires more time, because its Length CD is greater than DE.

Therefore it is plain, that what is got in Force, is lost in Space, as has been already prov'd in other Engines.

WEIGHT is a Quality in natural Bodies, whereby they tend downwards, towards the Centre of the Earth.

Or *Weight* may be defin'd to be a Power inherent in all Bodies, whereby they tend to some common Point, call'd the Centre of *Weight* or *Gravity*; and that with a greater or less Velocity, as they are more or less *dense*, or as the Medium they pass thro' is more or less rare.

But there may yet be another Definition. As in Effect one may conceive *Gravity* to be the *Quality*, as inherent in the Body; and *Weight* the same Quality exerting it self, either against an Obstacle or otherwise.

Hence Weight may be distinguish'd like Gravity into *absolute* and *specifick*.

Sir *I. Newton* demonstrates, that the *Weights* of all Bodies, at equal Distances from the Centre of the Earth, are proportionable to the Quantity of Matter that each contains.

Whence it follows, that the Weights of Bodies have not any Dependance on their Forms or Textures; and that all Spaces are not equally full of Matter.

Hence it follows, that the *Weights* of the same Body, is different on the Surface of different Parts of the Earth; by Reason that its Figure is not a Sphere, but a Spheroid.

The Law of this Difference the Author gives in the following Theorem.—The Increase of Weight as you proceed from the Equator to the Poles, is nearly of the versed Sine of double the Latitude; or which amounts to the same: as the Square of the Right Sine of the Latitude.

WEIGHT [in *Mechanicks*] is any Thing that is to be rais'd sustain'd or mov'd by a Machine; or any Thing that in any Manner resists the Motion to be produc'd.

In all Machines there is a natural Ratio between the *Weight* and the moving Power. — If the Weight be increas'd, so must the Power too; that is, the Wheels, &c. are to be multiply'd, and so the Time increas'd, or the Velocity diminish'd.

WELDING *Heat* [in *Smithery*] a Degree of Heat which Smiths give their Iron in the Forge; when there is Occasion to double up the Iron, and to weld a work in the doublings; so that the Iron shall grow into a Lump, thick enough for the Purpose.

WELL [in *Building*] is a Hole

Hole left in the Floor for the Stairs to come up thro'.

WELL, a narrow Opening of a cylindrical Form, made by digging in the Earth: Wells where they are not natural, are principally made, in order to have Water in those Places where it is wanted.

In digging for a Well, you must do it in a Place remote from Houses of Offices, Stables, Dunghils, and other Places, which by their Stench may impart a very disagreable Taste to the Water: as for the Goodness of the Water, that depends upon the Nature of the Place where the Well is digged; for if the Earth be sandy or black, or inclines to a Potters Clay, and white, slimy Soil, or to speak more properly, if it has Flint and Sand together, then there is no doubt to be made but that the Water will be very good.

On the contrary, if it be spungy, or has Chalk or Mud therein, it will not answer the Purpose; and happy are they who have Grounds endued with those Qualities that are necessary for yielding good Water; otherwise there is no Remedy.

There are several Persons who have Houses near Meadows, and have a mind to dig for Wells, believing they may save Money by making them in such Places, and observing those where Willows are planted, or else, where Reeds grow, whose Nature has an entire Tendency to Moisture; they fix their Plan immediately there, and fancy a Well dug at such a Place and with a small Expence, cannot but be lasting; but they are much mistaken, for tho' these Places are very moist, yet the Wells that are made there, are much more subject to dry up than others; and the Water is generally good for nothing.

Wells must be always kept in Repair, the Labour is not great; and no further Care is to be had, than to cleanse them once a Year, and that no Filth of any Kind be thrown into them.

But in Opposition to the Opinion of those who keep their Well covered in order to preserve them clean, it may be affirm'd, that they cannot be kept too open, that the Air may have a free Passage, which subtilizes the Nature of the Water, and makes it much purer than otherwise it would be without this Help.

If you would drink good Well Water, you must draw it often; for it is most certain, that the oftener Water is drawn, the less gross the Parts will be that compose it; and consequently it will be more conducive to your Health.

If you would have Wells near the Sea, with fresh Water, dig a good large Ditch or Pit, as of about 100 Foot Diameter; having first planted very long Stakes or Piles, cleanse it well, throw out the Mud; besides these Stakes, by the Help of which you defend it against the Tide; and when the Pit is dry, and that there is no wet in it, you

are to fix another Row of very long Piles, about ten Foot distant from the first, and likewise throw out the Mud, and this should be done three or four times, till you come at fresh Water.

When by any of the before-mention'd Trials in the Article *Water*, a Place has been pitch'd upon that is proper to bore, you must provide your self with a large Augar, that may be grafted at every five or six Foot; and having made a Hole in the Top of the Ground, where yon intend to bore, about three or four Foot wide, or more, to give Room for the Workmen to make the Experiment the better, then you may proceed; and when you have bor'd one Length of the Augar of four or five Foot, as aforesaid, then graft on another Length, and so on, till you come down to the Water, ever and anon pulling out your Augar and cleansing it, to examine what Soil you bore through.

When you dig for a Well, great Care ought to be taken, not only in stewing the Sides, to keep the Earth from falling in upon the Workmen; but to take Care that the Effluvias of the Water (which if bad) do not hurt them; for it has been often found, that the Water which is under the Earth, hath many bad Qualities, and emits Vapours, which ofren stifle those that work in the Well after it has been dug.

To prevent which, the Ancients (as *Vitruvius* has it) were wont to let a Lamp gen ly down into it, and if it ex tinguish'd it. they took it fo an infallible Sign that the Wa ter was bad.

WHEEL [in *Mechanicks* is a simple Machine, consistin of a round Piece of Wood, Me tal or other Matter; turnin round on an Axis.

The *Wheel* is one of the prin cipal *Mechanick* Powers, it ha Place in most Engines; and indeed 'tis of an Assemblage o *Wheels* that most of our chie Machines are compos'd, a Mills, &c.

Its Form is various, according to the Motion it is to have, and the Use it is to answer, and is accordingly distinguish'd into *simple* and *dented*.

Simple Wheels are such whose Circumference and Axis is uniform, and which are us'd singly, and without a Combination.

Such are the *Wheels* of Carriages which are to have a double Motion; the one circular about their Axis; and the other rectilineal; by which they advance along the Road, &c. which two Motions they appear to have, tho' in Reality they have but one; it being impossible that the same Thing should move or be agitated two different ways at the same time.

This one is a spiral Motion, as is easily seen by fixing a Piece of Chalk on the Face of a *Wheel*, so as it may draw a Line on a Wall, as the *Wheel* moves.

The Line it here traces, is a just

ast Spiral, and still the more urve as the Chalk is fix'd earer the Axis.

In Wheels of this Kind, the Height ought to be always roportioned to the Nature of he Animal that draws or moves them.

The Rule is, that the Axis and Load of the Wheel be of the same Height, with the Force that moves them; or else the Axis being higher than the Beast, Part of the Load will lie on him; or if it be lower, he will pull at a Disadvantage, and must exert a greater Force.

Dr. *Wallis* and others have shewn, that to draw a Vehicle, *&c.* over waste uneven Places, it will be best to fix the Traces to the Wheels lower than the Horse's Breast.

The Power of these Wheels results from the Difference of the Radii of the Axis and Circumference.

The Canon is this: As the Radius of the Axis is to that of the Circumference, so is any Power to the Weight it can sustain hereby.

This is also the Rule in the Axis in *Peritrochio*; and the Wheel and the Axis in *Peritrochio*, See *Plate*, *Fig.* 6. are in effect, the same Thing; only in Theory it is usually called by the former Name, and in Practice by the latter.

Dented Wheels are those whose Circumference, or else Axis, is cut in Teeth, by which they are rendred capable of moving and acting one on another, and of being combined together.

The Power of dented Wheels depends on the same Principle, as that of the simple one. The Difference is only that to the simple Axis in *Peritrochio*, which a compound Lever is to a simple one.

Its Doctrine is comprised in the following Canon, *viz. The* Ratio *of the Power to the Weight, in order for that to be equivalent to this, must be a* Ratio *compounded of the* Ratios *of the Diameter of the Axis of the last Wheel, to the Diameter of the first, and of the* Ratio *of the Revolutions of the last Wheel, to those of the first in the same Time.*

But this Doctrine will deserve a more particular Explication.

1. Then if the Weight be multipled into the Product of the *Radii* of the Axis, and that Product be divided by the Product of the *Radii* of the Wheels, the Power required to sustain the Weight will be found.

2. If the Power be multiplied into the Product of the *Radii* of the Wheels, and the *Factum* be divided by the Product of the *Radii* of the Axis; the Quotient will be the Weight which the Power is able to sustain: thus if the Power be 22 $\frac{1}{2}$ of a Pound, the Weight will be 6000 Pounds.

3. *A Power and a Weight being given to find the Number of Wheels, and in each Wheel, the* Ratio *of the Radius of the Axis to the Radius of the Wheel: So as that the Power being applied perpendicularly to the Periphery of the last Wheel,*

Wheel, may sustain the given Weight.

Divide the Weight by the Power: Resolve the Quotient into the *Factors* which produce it, then will the Number of *Factors* be the Number of *Wheels*; and the *Radii* of the Axis will be to the *Radii* of the *Wheels*, as *Unity* is to the several *Wheels*.

As suppose for Example, a Weight of 3000 Pound, and a Power of 60, which resolves into these *Factors* 4,555 Four Wheels are to be made, in one of which the Radius of the Axis is to the Radius of the Wheel, as 1 to 4. In the rest, as 1 to 5.

4. If a Power move a Weight by the means of two Wheels, the Revolutions of the slower Wheel, are to those of the swifter, as the Periphery of the swifter Axis is to the Periphery of the Wheel which catches on it.

5. If a Power move a Weight by means of divers Wheels, the Space pass'd over by the Weight is to the Space of the Power, as the Power is to the Weight. Hence it follows, that the greater the Power is, the faster will the Weight be moved, and *vice versa*.

6. The Spaces pass'd over by the Weight and the Power, are in a *Ratio* compounded of the Revolutions of the slowest Wheel, to the Revolutions of the swiftest; and of the Periphery of the Axis of that, to the Periphery of this.

Hence, since the Space of the Weight and the Power, are reciprocally as the sustaining Power to the Weight; th Power that sustains a Weigh will be to the Weight, in *Ratio* compounded of the Re volutions of the slowest Wheel to those of the swiftest, and o the Periphery of the Axis o that, to the Periphery of this.

7. *The Periphery of the Axi of the slowest Wheel, with th Periphery of the swiftest Wheel given; as also the* Ratio *of the Revolution of the one to those of the other, to find the Space which the Power is to pass over, while the Weight goes any given Length.*

Multiply the Periphery of the Axis of the slowest Wheel into the antecedent Term of the *Ratio*, and the Periphery of the swiftest Wheel into the consequent Term; and to these two Products, and the given Space of the Weight, find a fourth Proportional: This will be the Space of the Power.

Suppose, for Example, the *Ratio* of the Revolutions of the slowest Wheel, to these of the swiftest, to be as 2 to 7; and the Space of the Weight 30 Feet: and let the Periphery of the Axis of the slowest Wheel be to that of the swiftest, as 3 to 8, the Space of the Power will be found to be 280.

8. *The Ratio of the Peripheries of the swiftest Wheel, and of the Axis of the slowest; together with the* Ratio *of their Revolutions, and the Weight being given, to find the Power able to sustain it.*

Multiply both the Antecedents and the Consequents of the given Ratio into each other, and

and to the Product of the Antecedents, the Product of the Consequents, and the given Weight, find a fourth Proportional, and that will be the Power required.

As suppose, for Example, the *Ratio* of the Peripheries 8 : 13 that of the Revolutions 7 : 2, and the Weight 2000, the Power will be found 214 $\frac{2}{7}$. After the same Manner may the Weight be found; the Power and the *Ratio* of the Peripheries, &c. being given.

9. *The Revolutions the swiftest Wheel is to perform, while the slowest makes one Revolution, being given; together with the Space, the Weight which is to be rais'd, and the Periphery of the slowest Wheel; to find the Time that will be spent in raising it.*

Say, as the Periphery of the Axis of the slowest Wheel is to the Space of the Weight given; so is the given Number of Revolutions of the swiftest Wheel to a fourth Proportional, which will be the Number of Revolutions performed, while the Weight reaches the given Height.

Then by Experiment determine the Number of Revolutions the swiftest Wheel performs in an Hour; and by this divide the fourth Proportional found before, the Quotient will be the Time spent in raising the Weight.

The Power of the Wheel by its Axle.

This Engine is of great use at the several Keys and Wharfs of *London*, in raising and taking up all manner of Goods of Burden, at their Loading and Unloading in and out of Ships, &c. where the Power applied is the Weight of Men who walk within the Wheel, and thereby raise the Weight required. See *Plate*, *Fig.* 4.

If you observe this Machine, and consider the Radius A O of the Wheel A B C D, with the Radius O G of the Axis, which move on their Centre O, it is plain, that it is nothing but a *Lever* of the first kind perpetually turned round; for A O is the Distance of the Power, O G, the Distance of the Weight, and the Centre O the *Fulcrum*. And therefore,

If a Weight is raised by Means of such a Wheel, with its Axle moving round its Centre, by a Power whose Line of Direction touches the Circumference of the said Wheel, the Power will be to the Weight, as the Radius of the Axle is to the Radius of the Wheel.

Suppose the Weight E in the Figure is raised by means of the Wheel A B C D, with its Axle E O G moving round the Centre O, by a Power Z, whose Line of Direction Z A touches the Circumference of the Wheel, as a Tangent raised from the Point A of the Radius A O; the Power A will be to the Weight I, as the Radius of the Wheel A O, is to the Radius O G of the Axle.

Let the Radius A O be = 10 Feet, the Radius O G = 1 Foot, and the Power applied at

A = 15 Pound Averdupois; then I say,

As the Radius of the Axle 1 Foot,

Is to the Radius of the Wheel 10 Feet,

So is 15 the Power applied to 150, the Weight at I, which is the Equipoise of the Power A required.

Again the Weight being given to find the Power.

As the Radius of the Wheel 10 Feet,

Is to the Radius of the Axle 1 Foot,

So is 150 the Weight given, to 15 the Power required.

The OPERATIONS.

1 : 10 :: 15 : 150
10
———
1)150(150

10 : 1 : 150 : 15
1
———
10)150(15

From these Operations, 'tis plain, that as much as the Radius of the Wheel is greater than the Radius of the Axle, so much is the Power of the Force increased, always supposing the Line of Direction of the Power to touch the Circumference of the Wheel, as A Z, whereby the Line O A Z will always be the same, and a right Angle to whatever Point of the Circumference is applied; for were the Line of Direction otherwise applied, this would not hold. As for Instance.

Suppose the Power were applied at L, and its Line of Direction L K perpendicular to Horizon, then it is evident, that the Distance of the Power from the *Fulcrum*, would be but = K O; and since that K O is less than A O, it is plain that the Power is thereby diminished, and made less than when applied at A as aforesaid.

It being thus demonstrated, that the Power of the Wheel and Axle is gain'd by the Difference of their respective Radius, it appears to be with this as with the other mechanical Powers, that whatever is gained in Force, is lost in Time and Space.

This is very easily understood; for as the Radius of the Axle makes but one Revolution in the same Time that the Radius of the Wheel makes one Revolution, 'tis evident, that the Circumference of the Wheel, which is greater than the Circumference of the Axle, must move with greater Force, and that proportionably to the Difference of their Radius.

In this Example, the Circumference of the Axle is = 3 $\frac{3}{20}$ nearly, and the Circumference of the Wheel = 31 $\frac{1}{2}$ nearly.

Now, if 31 $\frac{1}{2}$ be divided by 3 $\frac{1}{10}$ nearly, the Quotient is = 10; that is, the Circumference of the Axle is contained 10 Times in the Circumference of the

the Wheel; wherefore the Wheel to raise the Weight one Foot in Height, must pass thro' a Space of 10 Feet; so that what it will have gain'd in Force, will be lost in Space, according to the Difference of the Radius, which is as 1 is to 10. Q E D.

WHISPERING Places depend on this Principle, that the Voice being applied to one End of an Arch, easily rolls to the other. Accordingly all the Contrivance of a whispering Place, is, that near the Person who whispers, there be a smooth Wall arch'd, either cylindrically or elliptically. A circular Arch will do, but not so well.

The most remarkable Places formed for the Conveyance of Whispers, are the Prison of *Dionysius* at *Syracuse*, which increases a soft Whisper to a Noise; the Clap of one's Hand, to the Sound of a Canon, *&c.*

The Aqueducts of *Claudius*, which are said to carry a Voice 16 Miles; and divers others, which *Kircher* mentions in his *Phonurgia*.

The most considerable Whispering Place in *England* is the Dome of St. *Pauls* in *London*, where the Ticking of a Watch may be heard from Side to Side, and a very easy Whisper be sent all round the Dome.

This Mr. *Derham* discovered to hold not only in the Gallery below, but above upon the Scaffold, where a Whisper would be carried over ones Head, round the Top of the Arch, tho' there is a large Opening in the Middle of it, into the upper Part of the Dome.

The famous Whispering Place in *Gloucester* Cathedral, is no other than a Gallery above the East-end of the Choir, leading from one Side of it to the other.

It consists of five Angles and six Sides, the Middlemost of which is a naked Window; yet two Whisperers hear each other at the Distance of 25 Yards.

WHITE LEAD is the Rust of Lead, or Lead dissolved by Vinegar, much used by Painters.

There are two ways of preparing it. 1. Either, by reducing the Lead into thin *Laminæ*, steeping them in strong Vinegar, and every 10 Days scraping off the Rust form'd on the Surface: and repeating this till the Lead is quite consumed.

2. Or by rolling the *Laminæ* into Cylinders, like Sheets of Paper, only so as there be a little Space left between the several Folds or Turns.

These *Laminæ* are suspended in the Middle of earthen Pots, at the Bottom of which is Vinegar.

These Pots being well closed, are buried in a Dunghill for 30 Days; after which, being opened, the Lead is found as it were calcined, and reduced into what they call White Lead, to be broken into Pieces, and dried in the Sun.

White Lead is used both in Painting in Oil and Water Colours, and makes a beautiful Colour in each; but it is something dangerous both in grinding

ing and uſing it, as being a rank Poiſon.

WICKET is a little Door within a Gate, or a Hole in a Door, thro' which to view what paſſes without.

WIND-BEAM. See *Collar-Beam.*

WINDLASS } WINDLESS } is a Machine uſed for raiſing huge Weights withal, as Stones, *&c.*

It is very ſimple, conſiſting only of three Pieces of Wood, a Roll or Axle-tree, and a Pulley. The Pieces of Wood meet at Top; being placed diagonally, ſo as to prop each other. The Axis or Roller goes thro' two of the Pieces, and turns them. The Pulley is faſtened at Top where the three Pieces join.

There are two Levers go thro' the Roll, by which it is turned, and the Rope which comes over the Pulley is wound off and on the ſame.

WIND-MILL is a Kind of Mill which receives its Motion from the Impulſe of the Wind.

The Wind-mill, altho' it is a very common Machine, has nevertheleſs ſomewhat in it more ingenious than is commonly imagined.

And it is allowed to have a Degree of Perfection, which few of the popular Engines have attained to, and which the Makers themſelves are very little aware of.

The Structure of a Wind-mill.

The internal Structure of the Wind-mill is much the ſame as that of Water Mills. The Difference between them lies chiefly in an external *Apparatus* for the Application of Power. See *Plate, Fig.* 5.

This *Apparatus* conſiſts of an Axis, through which paſs two Rods or Yards, and interſecting each other at right Angles, whoſe Length is uſually about 32 Feet.

On theſe Rods are formed a Kind of Sails, Vanes, or Flights, in the Figure of *Trapeziums*, with parallel Baſes, the greater of which is about 6 Feet, and the leſt determined by *Radii* drawn from the Center.

Theſe Sails are to be capable of being always turned to the Wind, that they may receive its Impulſe: in order to which, there are two different Contrivances, which conſtitute the two different Kind of Wind-mills.

In the one, the whole Machine is ſuſtained upon a moveable *Arbor* or Axis, perpendicular to the Horizon, on a Stand or Foot; and turned occaſionally this way or that, by means of a Lever.

In the other, only the Cover or Roof of the Machine, with the Axis and Sails turn round; in order to which the Cover is built Turret-wiſe, the Turret being encompaſs'd with a Wooden Ring, in which is a Groove, at the Bottom of which a Number of Braſs Truckles are placed at certain Diſtances, and within this Groove is another Ring, upon which the whole Turret ſtands.

To the moveable Ring is connected Beams, and to the Beam

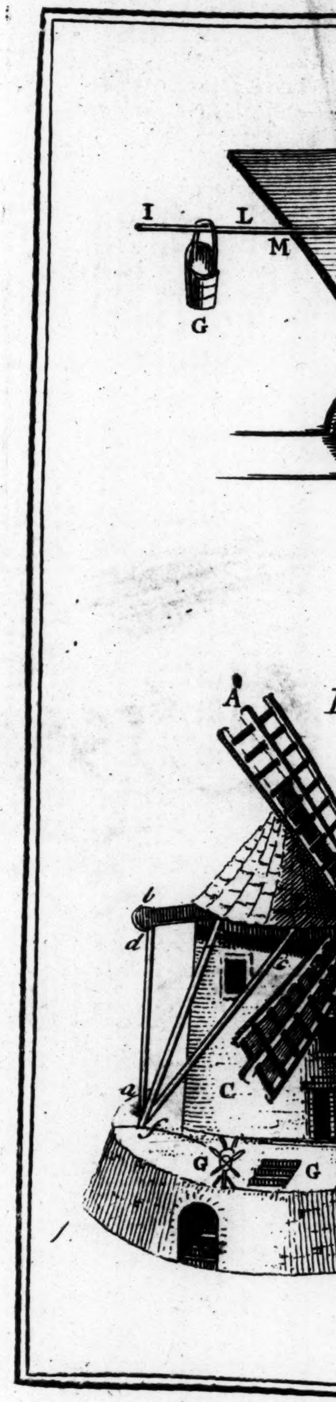
I
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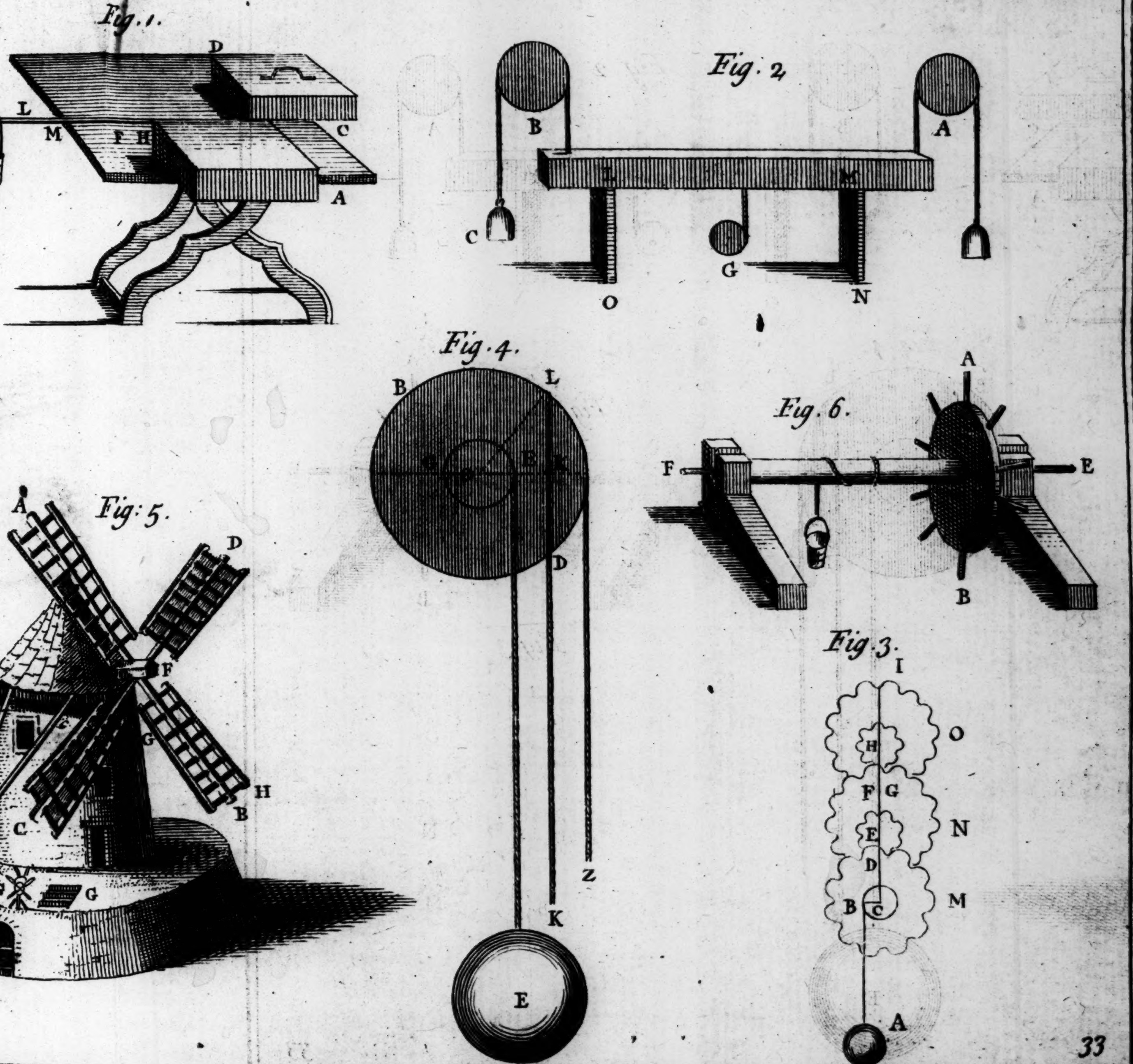
Plate XXXIII.



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Beam is faſtened a Rope, which at the other Extreme of it, is fitted to a Windlaſs or Axis in *Peritrochio*: This Rope being drawn through an Iron-Hook, and the Windlaſs turn'd, the Sails will be moved round, and put in the Direction required.

The Theory of the Motion of a Wind-mill, with the Poſition of its Vanes and Sails.

The Angle which the Sails are to make with their common Axis, ſo that the Wind may have the greateſt Effect, is a Matter of nice Enquiry, and has employed the Thoughts of Mathematicians.

The Theory of compound Motion muſt be ſuppoſed in order, to conceive why a Wind-mill moves at all. A Body that moves perpendicularly againſt any Surface, ſtrikes it with all its Force. If it move parallel to the Surface, it does not ſtrike it all; and if it move obliquely, its Motion being compounded of the perpendicular and the parallel Motion, only acts on the Surface, conſidered as it is perpendicular, and only drives it into the Direction of the Perpendicular.

So that every oblique Direction of a Motion is the Diagonal of a Parallelogram, whoſe perpendicular and parallel Directions are the two Sides.

Add to this, that if a Surface which being ſtruck obliquely, has only received the perpendicular Direction, be faſtened to ſome other Body, ſo that it cannot purſue its perpendicular Direction, but muſt change it for ſome other; in that Caſe, the Perpendicular it ſelf becomes the Diagonal of a new Parallelogram, one of whoſe Sides is the Direction, the Surface may follow, and the other, that it cannot.

Thus a Rudder faſtened obliquely to the Keel of a Veſſel, being ſtruck by the Current of Water parallel to the Keel, and of Conſequence obliquely with reſpect to it ſelf, it will appear by drawing the Line of perpendicular Impulſe, that it tends to tear the Rudder from the Keel, and to carry it away: and that this Direction perpendicular to the Rudder is oblique to the Keel.

The Rudder then would be carried off in an oblique Direction; but as in Effect it is ſo ſecured, that it cannot be torn or carried off, we are only to conſider in this compound Motion, that of the two Directions, wherewith it can move without being torn from the Keel, and leave the other, which would tear it off, as uſeleſs.

Now the Direction in which it can move, without parting from the Keel, is that which carries it circularly about its Extremity, as a Centre.

So that the Effect of the oblique Impulſe of the Water on the Rudder, is reduced, firſt to a perpendicular Impreſſion, which is again reduced to the mere turning the Rudder round; or if the Rudder be immoveable, to the turning of the Veſſel.

Now in an oblique and compound Motion, where only one of the Directions is of Service, the greater *Ratio* the other has to it, the leſs Effect will the Motion have, and *vice verſa*.

In examining the compound Motions of the Rudder, we find, that by how much the more oblique it is to the Keel, the *Ratio* of Direction which ſerves to turn it to the other, is the greater.

But on the other Hand, by how much the more oblique it is to the Keel, and conſequently to the Courſe of the Water, which is ſuppoſed parallel to it, it will ſtrike by ſo much the more weakly.

The Obliquity of the Rudder therefore has, at the ſame Time, both an Advantage and Diſadvantage; but as thoſe are not equal, and as each of them are ſtill varying, with every different Poſition of the Rudder, they become variouſly complicated; ſo that ſometimes the one prevails, and ſometimes the other.

It has been the Subject of Enquiry, to find the Poſition of the Rudder, wherein the Advantage ſhould be the greateſt. Mr. *Renau*, in his famous Theory for the working of Ships, has found, that the beſt Situation of the Rudder, is when it makes an Angle of 55 Degrees with the Keel.

If now a Wind-mill expoſed directly to the Wind, ſhould have its four Sides perpendicular to the common Axis wherein they are fitted; they would receive the Wind perpendicularly, and it is viſible that Impulſe would only tend to overturn them.

There is a Neceſſity therefore to have them oblique to the common Axis, that they may receive the Wind obliquely.

For the more eaſily conceiving, let us only conſider one vertical Sail. The oblique Impulſe of the Wind on this Sail is reducible to a perpendicular Impulſe; and that Direction, as the Sail cannot abſolutely keep to it, is compounded of two; one of which tends to make it turn on its Axis, and the other to fall backwards.

But it is only the firſt of theſe Directions can be obeyed, and conſequently the whole Impulſe of the Wind on the Sail, has no other Effect, but to make it turn from Right to Left, or from Left to Right as its acute Angle turns this way or that. And the Structure of the Machine is ſo happy, that the three other Sails are determined, from the ſame Reaſons, to move the ſame Way.

The Obliquity of the Sails with reſpect to their Axis, has exactly the ſame Advantage and Diſadvantage with the Obliquity of the Rudder to the Keel. And M. *Parent* ſeeking by the new Analyſis, the moſt advantageous Situation of the Sails on the Axis, finds it preciſely the ſame Angle of 55 Degrees; yet this Rule is very little obſerved in Practice, as, indeed, being but little known. They are uſually made about 60 Degrees, which is very much out of the way.

An Elliptical Wind-mill.

M. *Parent* has considered further, what Figure the Sails of a Wind-mill shall have, so as to receive the greatest Impulse of the Wind; and he determines it to be a Sector of an Ellipsis, whose Center is that of the Axis or *Arbor* of the Mill, and the little Semi-Axis the Height of 32 Feet. As for the greater, it follows necessarily, from the Rule that directs the Sail, to be inclined to the Axis 55 Degrees.

On this Foot he assumes 4 such Sails, each of which is $\frac{1}{4}$ of an Ellipsis; which he shews will receive all the Wind, and lose none, as the common ones do. These four Surfaces multiplied by the Lever with which the Wind acts on one of them, express the whole Force the Wind has to move the Machine, or the whole Force the Machine has when in Motion.

The same Manner of reasoning applied to a common Wind-mill, whose Sails are rectangular, and their Height about 5 Times their Breadth; shows that the Elliptical Wind-mill has above 7 Times the Force of the common ones, which is a prodigious Advantage; and therefore certainly deserves to have the common Practice set aside, if so common a Practice could be easily changed.

He shews, that a Wind-mill with six elliptical Sails, would still have more Force than one with four.

It would only have the same Surface with the 4; since the four contain the whole Space of the Ellipsis as well as the 6.

But the Force of the six would be more than that of the four, in the *Ratio* of 245 to 231.

If it were desired to have only two Sails, each being a Semi-ellipsis, the Surface would be still the same; but the Force would be diminished by near $\frac{1}{3}$ of that with six Sails; by reason the greatness of the Sectors would much shorten the Lever with which the Wind acts.

The best Form and Proportion of Rectangular Wind-mills.

But as elliptical Sails would be something so new, that there is little reason to expect they will come into common use; the same Author has consider'd which Form among the Rectangular ones will be the most advantageous, *i. e.* which the Product of whose Surface, by the Lever of the Wind, will be the greatest.

And by the Method, *De maximis et minimis*, he finds it very different from the common ones.

The Result of this Enquiry is, that the Width of the Rectangular Sail, should be nearly double its Height or Length, whereas the Height or Length are usually made almost five Times their Width.

Add to this, that as their Height or Length is the Dimension taken from the Centre of the Axis; the greatest Dimensions of the new Rectangular Sail, will be turned towards the Axis, and the smallest from it, which is quite contrary

ry to the Poſition of the common Sails.

The Force of a Wind-mill with 4 of theſe new Rectangular Sails, Mr. *Parent* ſhews, will be to the Force of 4 elliptic Sails, nearly as 13 to 24, which leaves a conſiderable Advantage on the Side of the elliptic ones; yet will the Force of the new Rectangular Sails be nearly 4 Times as great as thoſe of the common ones.

M. *Parent* likewiſe conſiders what Number of the new Sails will be moſt advantageous, and finds that the fewer Sails, the more Surface there will be, but the leſs Force.

The *Ratio* of the Force of a Wind-mill with ſix Sails, will be to another with four, nearly as 14 to 13, and the Force of another with 2, will be to that with 4, nearly as 13 to 9.

As to the common Wind-mill, its Force ſtill diminiſhes as the Breadth of the Sails is ſmaller, in Proportion to the Height. Therefore the uſual Proportion of 5 to 1, is exceedingly diſadvantageous.

The Uſes of this new Theory of Wind-mills are very obvious.

The more Force a Wind-mill has, the ſwifter it turns, the more it diſpatches, and the leſs Wind it needs.

To this may be added, that on this Theory, one may have a Windmill, whoſe Sail ſhall be a deal leſs, and yet the Force a deal greater than in the common ones.

WIND-MILL, a Mill driven or turned by the Wind, contrived for the overflowing and watering of *Land*.

Several Mills of this Kind have been uſed; ſuch as the horizontal Wind-mill, which by a Wheel with Buckets, or Scoops fixed upon Chains, as alſo, by a Wheel carrying the Water up in Buckets, fixed thereunto, caſts the ſame forcibly from it, by the Swiftneſs of it Motion.

But that is reputed the beſt made with vertical Sails, like the ordinary Wind-mills, only more in Number, but not ſo long, placed upon an Axis of a proportionable Length to the Length of the Vanes, the one End reſting on a hollow moveable Piece of Timber, that will move round over the Pump as there is Occaſion to turn the Vanes, the other End reſting on a Semi-circle, in which are ſeveral Notches or Stays, ſo that it may be placed as you pleaſe, that be the Wind which way it will, by the Motion of that or the Semi-circle, you will have it at the one Side of the Vanes or the other.

Let the Pump over which one End of the Axis reſts, be placed in the Pit or Well, out of which you intend to raiſe the Water, and the Noſe or Mouth of ſuch a Height, as you think fit to convey the Water into a Trough; which Pump may be made of what Diameter you think convenient, according to the Strength of the Wind-mill, and Height that the Water is to be raiſed.

The Trunk of the Pump may be made round, or if you would have it made large, then a Square may ſerve as well;

the

the Bucket muſt be always dipt into the Level of the Water, which prevents much Trouble and Injury to the Work.

The Handle of the Pump muſt be extended in Length, to the Axis of the Wind-mill, which muſt be made crooked to receive and move the ſame, like to the Axis of a Cutler's Grind-ſtone, or *Dutch* Spinning Wheel, turned with the Foot; or the End of the Axis of the Wind-mill may reſt on a Cylinder or Box, made moveable on the Top of the Pump itſelf, with the crooked Neck or End within the Cylinder; ſo that when you turn it any way, ſtill the End of the Axis is perpendicular over the Pump.

A Channel alſo covered or open, muſt be to convey the Water out of the River into the Pit or Well, wherein the Pump ſtands, and care muſt be taken, that the Handle or Rod of the Bucket, be ſo made, that it may, Swivel-like, turn any way, as you turn your Wind-Vanes, without twiſting or otherwiſe injuring the Bucket; which Wind-mill or Machine, by any reaſonable Gale of Wind, will raiſe a very great Quantity of Water proportionable to its Strength and Weight, with Eaſe; being made with a ſmall Charge, comparatively, and being not compoſed of very many Parts, it requires the leſs Repair, and is leſs ſubject to Damage by violent Winds. About 30 Years ago, there was a Wind-mill erected near the *New-River*, between *London* and *Iſlington*, with ſix *Wings*, being the admirable Contrivance of that ingenious Architect Mr. *Surrocole*, in order to convey Water from the lower Ponds, through Pipes under Ground, to a new one made on the Top of the Hill, conſiſting of an Acre of Ground, which ſerves ſucceſsfully to ſupply the great Increaſe of new Buildings of *London*, eſpecially to the Weſt-ward; but a ſudden Guſt of Wind, or rather a Whirle-wind, blew it down about 20 Years ago: however it was ſoon reſtored: It was alſo on the 20th of *November* 1720, blown down again, by a terrible high Wind that then happened; but the Proprietors have not thought fit to put up the Sails again, but erected another Mill near it; both which are drawn by Horſes.

WINDOWS, *q. d. Wind-doors*, are Apertures or open Places in the Side of an Houſe, to let in Air and Light.

There are various Kinds and Forms of Windows, Wire Windows, Horn Windows, *&c.*

Arch'd Windows, Circular Windows, Elliptical Windows, Square and Flat Windows; Round Windows, Oval Windows, Gothick Windows, Regular Windows, Ruſtick Windows, and Sky Lights.

The chief Rules in regard to Windows, are,

1. That they be as few in Number, and as moderate in Dimenſions as may conſiſt with other due reſpects; in as much as all Openings are Weakenings.

2. That they be placed at a convenient Diſtance from the Angles or Corners of the Building, becauſe that Part ought not to be open and enfeebled, whoſe Office is to ſupport and faſten all the reſt of the Building.

3. That Care be taken that the Windows are all equal one with another in their Rank and Order; ſo that thoſe on the Right Hand may anſwer to thoſe on the Left, and thoſe above be right over theſe below: For this Situation of Windows will not only be handſome and uniform, but alſo the Void being upon the Void, and the Full upon the Full, it will be a great Strengthening to the whole Fabrick.

As to their Dimenſions, Care is to be taken not to give them more or leſs Light than is needful; that is, to make them no bigger, nor leſs, than is convenient; therefore regard is to be had to the Bigneſs of the Rooms which are to receive the Light: 'Tis evident, that a great Room needs more Light, and conſequently a greater Window than a little Room, and *e contra*.

The Apertures of Windows in Middle-ſized Houſes, may be four and a half, or five Feet between the Jaumbs, and in greater Buildings ſix and a half, or ſeven Feet, and their Height may be double their Length at the leaſt.

But in high Rooms, or larger Buildings, their Height may be a Third, a Fourth, or Half their Breadth more than double their Length.

Theſe are the Proportions of the Windows for the firſt Story; and according to theſe muſt the upper Stories be for Breadth; but as for Height, they muſt diminiſh: The ſecond Story may be one third Part lower than the firſt, and the third one fourth Part lower than the ſecond.

As to the Price of making Windows.] Mr. *Leybourn* ſays, Window Frames are ordinarily agreed for by the Light; ſo that if a Window have four Lights, and it be double rabetted (as the Workmen call it) it may be worth 12 *s.* that is 3 *s.* a Light for Workmanſhip and Materials. But if the Builder find Timber and Sawing, then 1 *s.* a Light will be enough.

Tranſom Windows. Theſe Mr. *Wing* ſays, are worth making (for great Buildings) 1 *s* 9 *d. per* Light, or 7 *s. per* Window. But ſome Workmen ſay they have 12, 14, 16 and 18 *d. per* Light.

Luthern Windows, ſays Mr. *Wing*; the making and ſetting up are valued from 9 to 14 *s per* Window, according to their Bigneſs.

Some Workmen ſay (if they ſaw the Timber) they have commonly 20 *s. per* Window.

Shop Windows. Theſe Mr. *Leybourn* ſays, will be afforded at the ſame Rate as plain or batton'd Doors. See *Doors*.

The Price of Painting.] Mr. *Leybourn* ſays, the Price of Paint-

Painting is not uſually meaſured, but valued at 3 *d.* 4 *d.* or 6 *d.* *per* Light, according to their Bigneſs, and Caſements, at Three Half-pence or Two-Pence *per* Piece, and Iron Bars at a Penny more, if very large.

Windows, ſays M. *le Clerc*, as well as Gates, differ both in their Bigneſs, and in their Architecture; the biggeſt are ſeen in Churches and Halls, *&c.* and are uſually arch'd to a Semi-circle.

The moderate ones frequently terminate in an Arch leſs than a Semi-circle. As to the ſmall ones, they are uſually long Squares, their Height being ſometimes double their Width, or very nearly ſo.

Both the one and the other are made more or leſs ſimple, or more or leſs rich, according to the Place, and the Architecture of the Buildings where they are uſed.

In the *Facade* or Front of a Building, the Windows ſhould be exactly perpendicular under one another; and to that End, Care muſt be taken, that they be all of the ſame Width; but in different Stories, their Height muſt be different; thoſe of the loweſt and uppermoſt Stories may be leſs high, as well as leſs adorned, than thoſe of the Middle, which are uſually for the Maſter's Story.

The Width of Windows in reſpect to that of their Jaumbs, *i. e.* with reſpect to the Breadth of the Wall between Windows, may be as 3 to 4 in temperate Climates, like that of ours; or as 3 to 5 in Climates that are colder or more hot; or as 3 to 6 in Countries ſtill more expoſed to violent Heat or violent Cold; but the various Situations of a Building with regard to *Eaſt* and *Weſt*, will always occaſion a Variation in the Proportion of Windows themſelves.

The Deſigns of Windows given us by *Vignola*, do very well, as reformed by M. *d' Aviler*, in the Tranſlation he has made of that Author; but it is uſual to have Windows much leſs adorned; and we often make them without any Ornament at all, beſides a Plat-band around them, and that too in fine Buildings.

Large Windows ſhould have a Corniſh that projects pretty much, to be a Shelter to thoſe who preſent themſelves at them; and in that Caſe, the Projecture ſhould be ſupported by two Conſoles, as well as the Reſt or leaning Place, that terminates the Window at Bottom.

The Conſoles of the Corniſh ſhould be as big at Bottom as at Top, that they may fall in regularly with the Jaumb and Chambranle.

The Breadth of the Chambranle or Window Frame, may be a ſixth Part of that of the Window.

Without the Chambranle is a Plat-band, ſerving it as an *Arriere-corps*, called a *Montant* or Window-poſts, which may have an equal Breadth with the Chambranle, or, on

Occaſion, a little leſs. It ſerves particularly to place the Conſoles of the Corniſh upon.

If the Corniſh be not ſupported upon Conſoles, this Plat-band ſhould be then narrower by one half, and without any Mouldings beſides thoſe that compoſe its Corniſh.

The Conſoles that ſupport the Reſt or Bottom of the Window, ſhould be plac'd underneath the Chambranle, and be equal to it in Breadth, and the Wreathings may be made to run out on the Sides.

The Height of theſe Conſoles muſt not exceed half that of the Opening of the Window at the moſt, nor fall ſhort of a third of that Opening, when the leaſt.

They are uſually made narrower at Bottom than at Top; but in M. *le Clerc*'s Opinion, it would be better to have them equally big.

The Top of the *Perron* or Aſcent, frequently terminates the Bottom of theſe Conſoles.

As for *Windows*, by Statute of 7 of Queen *Anne*, it is ordered as follows.

Whereas it has been the Practice of Workmen to place Window Frames, and Door-caſes very near, and quite ranging with the Outſide Face of the Wall, whereby they are not only fully expoſed to Weather, and thereby decay ſooner, than thoſe that are ſheltered, by being placed at a moderate Diſtance within the Walls, but in time of Fire are more liable to be fired, whereby many Houſes may be deſtroyed; for Prevention of ſuch Practice, it is enacted, that after the firſt Day of *June* 1709, no Door Frame, or Window Frame of Wood, to be fixed in any Houſe or Building within the Cities of *London* and *Weſtminſter*, or their Liberties, ſhall be ſet nearer to the Outſide Face of the Wall than 4 Inches; nor ſhall any Brick-work bear, or be placed upon Timber, or any Sort of Brick-work, excepting upon Plank and Piles where Foundations are bad, on Pain of three Months Impriſonment, without Bail or Mainprize.

But by a Statute made in the 11th of King *George* I. it is made lawful to place Brick-work upon, or over Door Caſes and Windows (provided that the Weight thereof is diſcharged by Arches turned over them) or on Lentils, Breaſt Summers, Story Poſts, or Plates, where required, for the Convenience of a Shop or Shops only.

WITHS. Theſe are uſed by Thatchers, to bind their Thatching Rods to the Rafters.

They are uſually ſold at 6 *d.* the Hundred, and one Hundred of them will do about 3 Square of Thatching; they uſing about 33 or 34 Withs, and as many Thatching Rods (which are of the ſame Price with the Withs) in a Square; for they bind down their Straw at every Foot or thereabouts, *viz.* at every other Lath (for they lath but two Laths in a Foot) and each Courſe

of Thatching (bound down with one Length of Rods) is about three Foot in Breadth.

WOOD. Great Precautions are to be used in buying of Wood; the Situation of the Place must first be considered: Secondly, The Merchant ought to be perfectly acquainted with the Nature and Quality of it; to observe how the Trees are furnished, and to see that they are thick enough for the Places and Uses they are design'd for: He ought also to have great Regard to the Bargain he makes, in respect to the Time of Payment, that he may make his Money of his Goods, and that he may meet with no Interruption in carrying them off the Ground.

Sometimes the Seller reserves to himself a Number of young Standards for Growth, which are to be mark'd; and therefore the Buyer should make it Part of his Bargain, that in Case any of them should happen to be bruis'd or broken by Accident, he is not to stand to and be answerable for the Damage that way, or otherwise done by the Workmen by Malice or Want of Care, for which the Seller must call them to an Account.

The Merchant likewise ought to covenant for a reasonable Price to clear the Place of the Wood he buys; and that as Woods do not always stand upon or near High-ways, and that many Times there is a Necessity they should be carried away over other Peoples Grounds, the Buyer ought to oblige the Seller to procure him free Passage for them to the Port, or to which Place he would convey them, without any Molestation or Hindrance.

It would be tedious to enumerate the many Articles necessary to be agreed in such Bargains or Contracts; that is to be left to every one's Prudence and Experience in that way of Dealing.

As for *Forrest* or *Timber-trees*, which are those that are suffered to grow, according to Notion, from 40 to 200 Years; to understand these aright as they are standing, is very different, and more difficult than that of Under-wood; in order to which, the Buyer must first examine the Nature of the Ground where the Forrests are situated; the Sizes of the Trees, and Uses they are designed for.

There are Forrests which the *French* call *Pleine Futages*, wherein the Trees stand so thick, that the Sun cannot penetrate into them, and are situated in a good Soil: Now the Wood had from thence is always of a very tender Nature, by reason of the continual Shade which makes it so, and is only proper for Joinery Work.

But if the Ground where the Forrest grows is sandy and stony, or else gravelly; or if the Trees grow in Hedges, and are fully exposed to the Sun, then you need not hesitate to purchase the Timber for Carpentry-work; for the Wood will be hard, and so fit for that Use.

The usual Time of cutting

down Wood, is from *Martinmas* to the End of *February*; and many have ſtrenuouſly contended that it ought to be done in the Wane of the Moon; but it is well known, that the Influences of that Luminary are not efficacious enough to work many of the Effects that are aſcrib'd to it, upon ſublunary Things.

He who buys Wood or Timber-Trees, muſt take Care, if they are not very numerous, to obſerve their Tallneſs and Thickneſs, and not content himſelf with the bare View of them in that reſpect, but make uſe of a Cord to meaſure; and he muſt likewiſe obſerve the Branches, and well weigh what they may yield, and write down a Computation of the whole, that he may take the beſt Meaſures he poſſibly can.

He ſhould have Somebody with him, and beginning at the Foot, meaſure two Fathom upwards, and when that is done, he may judge of the reſt by his Eye proportionably, and ſo adding the whole together, he will very near aſcertain thereby the Height of the Tree.

To know the Thickneſs of a Tree, take a Cord or Line, with which encompaſs the Tree; and that if it be ſix Foot about, fold the Cord into three equal Parts; take off one, and folding the other two remaining ones into 12, in order to take off one Part more; when you have done that, fold the Remainder into four Parts, and you have no more to do than to meaſure the Length thereof, and that will ſhew the Thickneſs of each Part of the Tree.

WREATHED Columns are uſually made very rich, and ſays M. *le Clerc*, ought never to be uſed, but in Places of Diſtinction, as in Altars, Tombs, Salons, and other Places where Magnificence is required.

They ſhould never be uſed to ſupport either Walls or Vaults, or any other conſiderable Burden, by reaſon of their Weakneſs; nor ſhould any thing be laid upon them, beyond a plain, ſlight and delicate Entablature: For tho' they appear by their Circumvolutions to have leſs Delicacy than the common Columns, yet in Effect they have leſs Solidity.

WYDRAUGHT, a Water-Courſe or Water-Paſſage, properly a Sink or Common-Sewer.

X

XYSTOS } XYSTUS } among the ancient *Greeks*, was a Portico of uncommon Length, either open or covered, where the *Athletæ* practiſed Wreſtling and Running. The Word is derived from *Xyon*, *Gr.* to poliſh; it being their Cuſtom to anoint their Bodies with Oil before the Encounter, to prevent their Antagoniſts from taking hold of them.

The *Romans* too had their *Xyſtus*, which was a long Iſle or Portico, ſometimes roofed over, and other times open, and ranged on each Side with Rows of Trees forming an agreeable Proſpect for the People to walk in.

Y

YARD. *A TABLE shewing what Number of odd Feet in a Yard superficial comes to, for any Price by the Yard, from one Farthing* per *Yard, to* 5 l.

The Price of the Yard.	Superficial Feet.		1 s.	1 d.	1 q.pts.	2 s.	2 d.	2 q.pts.	3 s.	3 d.	3 q.pts.
	Pounds	1	2	2	2,67	4	5	1,33	6	8	0,00
	Pounds	2	4	5	1,33	8	10	2,67	13	4	0,00
	Pounds	3	6	8	0,00	13	4	0,00	20	0	0,00
	Pounds	4	9	10	2,67	17	9	1,33	26	8	0,00
	Pounds	5	12	1	1,33	23	2	2,67	33	4	0,00
	Shillings	1	0	1	1,33	0	2	2,66	0	4	0,00
	Shillings	2	0	2	2,66	0	5	1,33	0	8	0,00
	Shillings	3	0	4	0,00	0	8	0,00	1	0	0,00
	Shillings	4	0	5	1,33	0	10	2,66	1	4	0,00
	Shillings	5	0	6	2,66	1	11	1,33	1	8	0,00
	Shillings	6	0	8	0,00	1	14	0,00	2	0	0,00
	Shillings	7	0	9	1,33	1	6	2,66	2	4	0,00
	Shillings	8	0	10	2,66	1	9	1,33	2	8	0,00
	Shillings	9	1	0	0,00	2	10	0,00	3	0	0,00
	Shillings	10	1	1	1,33	2	12	2,66	3	4	0,00
	Pence	1	0	0	0,44	0	0	0,89	0	0	1,33
	Pence	2	0	0	0,89	0	0	1,78	0	0	2,66
	Pence	3	0	0	1,33	0	0	2,67	0	1	0,00
	Pence	4	0	0	1,77	0	0	3,54	0	1	1,33
	Pence	5	0	0	2,22	0	1	1,43	0	1	2,66
	Pence	6	0	0	2,66	0	1	2,32	0	2	0,00
	Pence	7	0	0	3,10	0	1	3,21	0	2	1,33
	Pence	8	0	0	3,55	0	2	0,10	0	2	2,66
	Pence	9	0	1	0,00	0	2	0,99	0	3	0,00
	Pence	10	0	1	0,44	0	2	1,88	0	3	1,33
	Pence	11	0	1	0,89	0	2	2,77	0	3	2,66
	Farth.	1	0	0	0,11	0	0	0,22	0	0	0,33
	Farth.	2	0	0	0,22	0	0	0,44	0	0	0,67
	Farth.	3	0	0	0,33	0	0	0,66	0	0	1,00

Super-

The Price of the Yard.	Superf. Feet.	4 s.	4 d.	4 q.pts.	5 s.	5 d.	5 q.pts.	6 s.	6 d.	6 q.pts.
Pounds.	1	8	10	2,67	11	1	1,33	13	4	0,00
	2	17	9	1,33	22	2	2,67	26	8	0,00
	3	26	8	0,00	33	4	0,00	40	0	0,00
	4	35	6	2,67	44	5	1,33	53	4	0,00
	5	44	5	1,33	55	6	2,67	66	8	0,60
Shillings.	1	0	5	1,33	0	6	2,66	0	8	0,00
	2	0	10	2,66	1	1	1,33	1	4	0,00
	3	1	4	0,00	1	8	0,00	2	0	0,00
	4	1	9	1,33	2	2	2,66	2	8	0,00
	5	2	2	2,66	2	9	1,33	3	4	0,00
	6	2	8	0,00	3	4	0,00	4	0	0,00
	7	3	1	1,33	3	10	2,66	4	8	0,00
	8	3	6	2,66	3	5	1,33	5	4	0,00
	9	4	0	0,00	5	0	0,00	6	0	0,00
	10	4	5	1,33	5	6	2,66	6	8	0,00
Pence.	1	0	0	0,44	0	0	2,22	0	0	2,66
	2	0	0	3,54	0	0	0,44	0	1	1,32
	3	0	1	1,32	0	1	2,68	0	2	0,00
	4	0	1	3,10	0	2	0,88	0	2	2,66
	5	0	2	0,87	0	2	3,10	0	3	1,33
	6	0	2	2,64	0	3	1,32	0	4	0,00
	7	0	2	0,42	0	3	3,54	0	4	2,66
	8	0	3	2,20	0	4	1,76	0	5	1,33
	9	0	3	0,93	0	4	3,98	0	6	0,00
	10	0	4	1,76	0	5	2,20	0	6	2,66
	11	0	4	3,53	0	6	0,42	0	7	1,33
Farth.	1	0	0	0,44	0	0	0,55	0	0	0,67
	2	0	0	0,88	0	0	1,10	0	0	1,33
	3	0	0	0,33	0	0	1,65	0	0	2,00

The Price of the Yard.

Superf. Feet.		7			8			9		
		s.	d.	q.pts.	s.	d.	q.pts.	s.	d.	q.pts.
Pounds.	1	15	6	2,67	17	9	1,33	20	0	0,00
	2	31	1	1,33	35	6	2,67	40	0	0,00
	3	46	8	0,00	53	4	0,00	60	0	0,00
	4	62	2	2,67	71	1	1,33	80	0	0,00
	5	77	9	1,33	88	10	2,66	100	0	0,00
Shillings.	1	0	6	1,33	0	10	2,66	1	0	0,00
	2	1	9	2,67	1	9	1,33	2	0	0,00
	3	2	4	0,00	2	8	0,00	3	0	0,00
	4	3	1	1,33	3	6	2,67	4	0	0,00
	5	3	10	2,67	4	5	1,33	5	0	0,00
	6	4	8	0,00	5	4	0,00	6	0	0,00
	7	5	5	1,33	6	2	2,67	7	0	0,00
	8	6	2	2,67	7	1	1,33	8	0	0,00
	9	7	0	0,00	8	0	0,00	9	0	0,00
	10	7	9	1,33	8	10	2,66	10	0	0,00
Pence.	1	0	0	3,10	0	0	3,55	0	1	0,00
	2	0	1	2,20	0	1	3,10	0	2	0,00
	3	0	3	4,40	0	2	2,65	0	3	0,00
	4	0	3	3,50	0	3	2,20	0	4	0,00
	5	0	4	2,60	0	4	1,75	0	5	0,00
	6	0	5	1,70	0	5	1,30	0	6	0,00
	7	0	6	0,80	0	6	0,85	0	7	0,00
	8	0	6	3,90	0	7	0,40	0	8	0,00
	9	0	7	3,10	0	8	0,95	0	9	0,00
	10	0	8	2,10	0	9	0,50	0	10	0,00
	11				0	10	0,05	0	11	0,00
Farth.	1	0	0	0,77	0	0	0,88	0	0	1,00
	2	0	0	1,54	0	0	1,76	0	0	2,00
	3	0	0	2,31	0	0	2,66	0	0	3,00

Explanation of this Table.

First, at the Head of the Table are the odd Feet contained in a Yard superficial, beginning at one Foot, and ending at a Yard.

At the Bottom of the Table you have the Number of Feet in a cubical Yard, numbred by 3, 6, 9, &c. to a Yard solid.

In the first Column on the left Hand, is placed the Price of a Yard, from one Farthing to 5 *l. per* Yard, and in the other Columns under the odd Feet, is the Price in Shillings, Pence, Farthings, and hundred Parts of a Farthing, that any Number of odd Feet come to.

The Use of the Table.

EXAMPLE 1.

At 8 d. *per Yard, what comes* 6 *Feet to?*

Look for 8 *d.* in the first Column, and under 6 Feet in the Angle of Meeting, you will find 00 *s.* 5 *d.* 1 *q.* 33; that is, 00 *s.* 5 *d.* ¼ 1 Farthing and 33 hundred Parts of a Farthing, which is the Price or Value of 6 Feet, at 8 *d.* the Yard superficial Measure.

EXAMPLE. 2.

At 5 s. 4. d. ½ *a Yard, what comes* 8 *Feet to?*

	s.	d.	q.pts.
8 Foot at 5 *s.* is	4 :	5 :	1,33
8 Foot at 4 *d.* is	0 :	3 :	2,20
8 Foot at ½ is	0 :	0 :	1,76
	4 :	9 :	1,29

Z

ZOCCO }
ZOCCOLO }
ZOCLE }
SOCLE } [*in Architecture*] is a small Kind of Standing or Pedestal; being a low Square Piece or Member serving to support a Busto, Statue, or the like, that there is Occasion to be rais'd.

The Word is *Italian*, form'd from *Soccus*, a Sandal, or high Shoe.

ZOCCO }
ZOCLE } also signifies a low Square Member serving to support a Column or other Part of a Building, instead of a Pedestal Base, or Plinth.

A continued ZOCLE is a kind of continued Pedestal whereon a Structure is raised; but having no Base or Cornish.

ZOOPHORUS }
ZOOPHOROS } [*in the ancient Architecture*] is the same Thing with the *Frieze* in the modern.

It was thus called in the *Greek*, because anciently adorned with the Figures of Animals from Ζῶον, an Animal, and φέρω, a Bear.

ZOOPHORICK Column, is a Statuary Column; or a Column that bears and supports the Figure of an Animal.

FINIS.

SUPPLEMENT.

The following are Additions and Corrections communicated to the Compiler of this Work after the Sheets were printed off, therefore not being willing to omit any Thing that may be of Service to the Publick, but to make this Work as compleat as possible, we have inserted them here by Way of Supplement.

IN the Article INTERTIES, for *smaller*, read *larger*.

In the Article JOISTS, for 10 read 12; for 8 Inches read 6; and for the Word *Furr* read *Bridge*.

In the Article KEYS, as to the Price, read from 2 or 3 *s.* to 20 *s.*

To the Article LATHS, add *Kentish Laths*, which are accounted as good as any are, about 1 ¼ Inch broad, and a full ¼ of an Inch thick, one with the other, and are sold in most Places of *Kent* for 2 *s.* 6 *d.* *per* Bundle.

To the Price of laying on Sheet LEAD in Roofing add, it is now worth 18 or 19 *s.* *per* Hundred Weight.

To the Article LIME after *Load of Lime*, add: here must be meant Ruble-Work, for square Stone-Work takes up much less Lime than Brick-work, and the Allowance is the same as is there mentioned.

To the Article LINTEL as to the Price, add: Carpenters put in these by the Cubed Foot, 20 *d.* for Firr and 3 *s.* for Oak.

To the Article MORTAR, after the Paragraph *How much allow'd*, &c. add: But if the Work be done well, it will take up near two hundred of Lime.

In the Article OGEE, leave out, or of a round or a hollow, like an S.

In the Article PAINTING, at Paragraph; *Out Door Work* instead of 3 *d.* &c. read, from 5 *d.* to 7 *d.* the Yard square.

In Paragraph, *Gates and outward Doors*, instead of 3 *d.* &c. read from 5 *d.* to 6 *d.* *per* Yard.

In *Sash Lights*, for 1 *s.* read 1 *d*

In *Sash Frames* read from 1 *s.* *per* Frame to 2 *s.*

In the Article PALEING, add; that they cleave only that Part of the Timber which is without Knots; but when they saw, they saw Knots and all; and for this Reason they can make it a great deal more by sawing than cleaving.

To PAVING with *Rough* or *Rag-Stone*, add: or 4*d. per* Yard Workmanship.

PEERS; instead of this Article, read,

PEER [in *Architecture*] a solid Wall between two Doors or Windows; also a short square Pillar, with Base and Capital, plac'd before a Gentleman's House for Ornament, and differs from a Pilaster in this, that they are shorter, and the Base and Capital are the same that Architects give to Pedestals.

In the Article PILES, after mortois'd, add tenon'd.

PLANE. Instead of the Articles *Plane* in the Dictionary, take these that follow.

PLANES have various Names, according to their various Forms and Uses.

The *Fore Plain* (or as the *Dutch* call it the *Fore Loper)* is about 18 Inches long; is the first used to take off the greater Irregularities of the Stuff, to prepare it for the *Trying Plane*, or the *Long Plane*; the Edge of its Iron is ground with a Convex Arch, to bear being set the ranker.

The *Trying* or *Long Plane*, is about two Foot long; its Use is to make the Work strait, and prepare it for the Jointer.

Jointer is the longest of all, about 2½ Foot long, the Edge of its Iron being very fine, its Use being to join two Boards together, and make both Edges perfectly strait and fit to glew.

It has been often said by some good Workmen, that there is nothing to be made perfectly strait, round or square; yet I believe a very curious Workman may do either of them, and demonstrate them to be so, as for Instance to make a Board strait.

Take two thin Boards, about three or four Foot long, more or less, and shoot them both together with a good Jointer till they will join and be close every way, which may easily be done by a good Hand. Then will both Edges of these Boards be perfect strait Lines, for otherwise they would not join and be close.

The *Smoothing Plane* is a short Plane about six or seven Inches long: its chief Use is to smooth and finish the Work.

The *Strike Block* is a short Jointer, about 13 or 14 Inches long, to join Mouldings and short Work.

The *Rabbet Plane*: The Iron of this Plane is full as broad as the Stock, that the Angle may cut strait, and it delivers its Shaving at the Sides, and not at the Top like other Planes; its Use is to make Slopes of Right Angles in the Edge of a Board, and Fillets in Mouldings, as the Anulets in the *Doric* Capital, &c.

The *Plow*. Its Use is to plow narrow square Groves in the

the Edge of a Board to receive the Edge of a thinner Board as the Edges of the Frameing is plowed to receive the Edges of the Panneling in a Room of Wainſcot.

Moulding Planes are of various Kinds, accomodated to the various Forms and Profiles of the Mouldings.

Round and Hollow Planes, are of ſeveral Sizes, from half a Quarter of an Inch, to two Inches and upwards; and curious Workmen have 16 Pair of theſe Planes, each differing half a Quarter of an Inch, with which, and the Snipes Bill and Rabbet Plane, they Work the various Sorts of Mouldings.

In the Article POINT, to the End, add, or Beginning of Magnitude.

Inſtead of the Article PUNCHINS, read, they are thoſe that are placed next a Door or Window, and are called Door or Window Punchins.

In the Article inclin'd PLANES, for *Obique* read *Oblique*.

In the Article the PULLEY, in the Article 3. *If a Power applied in B*, &c. in the 3d Line of the ſecond Column, for G E read G F; in Line 8, for F L read E L and in Line 9, for B read F.

In Article RAILS, add; But the Price of theſe is various, according to the Workmanſhip.

RAISING Pieces [in *Carpentry*] are thoſe Pieces that lie on the Tops of the Poſt and Punchions, and under the Beams; thoſe that lie on Brick-work, and under the Beams, are called Platbands.

In the Article RHOMBOIDES, in Column 2, Line 9, for A B C, *read* A B C D; and Line 18, for B C *read* D C; and Line 21, for C B E, *read* C B F.

In the Article ROOFS, in the Sheet whoſe Signature at the Bottom is P, in the ſecond Page, and ſecond Column, and ſecond Line, for *Carvings*, read *Furrings*; and after Line 20, the ſix Particulars beginning 1 Chamber Beam, and ending 6 Battlements, do all belong to the Article, entituled Flat-Roofs, *Plate* 3, and are immediately to follow the End of that Article, the laſt Line of which is; *Drips may be made to walk on.*

To the Article SAND, add, Pit-Sand is much inferior to River-Sand, becauſe not purged; Sea-Sand is the worſe becauſe ſalt; but that Sand taken from *Barkin-ſhelf*, which is between freſh and ſalt, will make good Mortar, as I have proved my ſelf.

In the Article SELLS, add, the Rates or Prices beforementioned are to be underſtood only of ſmall Buildings: for putting in Sells to large Houſes in *London* is very dear Work, the Price of which cannot be aſcertained.

In the laſt Paragraph, juſt before STAIR CASE, immediately after the Words; *by the Number of Stairs*, add the following Words; *leſs by one*; *for the laſt Riſe-up is not to be accounted in the Breadth.*

At

At the latter End of the Article Stair-cases, add, tho' these Sort of Elm-Stairs were much in use after the Fire of *London*, and might be the Price at that Time; yet the Price of Stairs cannot be ascertained, there is so much Difference in the Goodness of the Workmanship.

To the Article SUMMER, add, *Summer* in *Carpentry* is a large Piece of Timber to which the Girders are fram'd.

Price of plain Tileing in *London* is 25 or 26 *s. per* Square, Ripping Old Tileing is worth from 14 to 18 *s. per* Square, according to the Goodness of the old Tiles.

Pan-tileing pointed is worth 1 *l.* 0 *s.* 6 *d.* plain *Ditto* 18 *s.* ript 10 *s.* *Dutch* glaz'd 1 *l.* 15 *s.* *English Ditto* 1 *l.* 10 *s.*

Those who have no mind to make use of the Tables for Tileing, &c. may find the Price or Value by this easy Method.

Admit a Piece of Tileing to be 46--8 Inches long, and 32 Foot broad, at 26 *s. per* Square; *What is the Amount?*

46-8
32

14.93-4 Which is 14 Square, 93 Foot and 4 Inches,
26 which multiply by 26 *s.* the Price.

8958
2986
8-8

388.26:8 Which is 388 Shillings and $\frac{26}{100}$, the 8 Parts not worth regarding in this Case = to 19 *l.* 8 *s.* 3 *d.*

Reduce the $\frac{26}{100}$ by the Rule aforegoing.

26
12

52 Which is 3 *d.* and near $\frac{1}{8}$ of a Penny not worth
26 regarding.

3.12
4

48

Another

Another Example to find the Value of a Piece of Tileing.

Suppose a Piece of Tileing to be 35 Foot 7 Inches long, and 22 Foot deep.

```
                35-7
                22
              ———————
                70
               70
                12-10
              ———————
                7.82-10      Which is 7 Square 82 Foot 10
                 27- 6          Inches, at 27 s. 6 d.
              ———————————
               5474
              1564
                  22-6
                391-0
                     5       Which is 10 l. 15 s. 3 1/4 40/100
              ———————————
Shillings     215.27-11
                  12
              ———————
                  54
                 27
                  11
              ———————
Pence           3.35
                   4
              ———————
Farthings       1.40
```

See

See how it will anfwer with the firſt Example.

	Feet.
A Square is	100
Three Quarters	75
Half	50
A Quarter	25
18 Feet	18
	268

268 Which is two Square, 68 Foot at 14 *s. per* Square

$$\begin{array}{r} 2.68 \\ 14 \\ \hline 1072 \\ 268 \\ \hline 37.52 \\ 11 \\ \hline 104 \\ 52 \\ \hline 6.24 \\ 4 \\ \hline .96 \end{array}$$

Which is 37 Shillings, and $\frac{52}{100}$, which reduced, is = to 1 *l.* 17 *s.* 6 *d.* $\frac{96}{100}$, almoſt a Farthing.

This Method is more exact than the Tables, very eaſy, and with much leſs Trouble, and I believe will be acceptable to thoſe whoſe Hands it may fall into.

To the Article TIMBER, add, How much Timber will compleat a Square of Building? *Anſwer*, Twenty Foot of ſolid Timber will compleat a Square or 100 Feet of ordinary Houſe Building, one Part with the other.

But large and maſſive Framing may take up double or treble that Quantity, and ſlight Framing may be done with leſs.

In the Article TIMBER, and in the Paragraph *Felling*, add, Felling Timber, and cutting the

the Top Wood, is from Two Shillings and Six Pence to Three Shillings and Six Pence, and hewing about Two Shillings.

In the Example 1. of Timber, for Sum 1 *l.* 03 *s.* 05 *d.* *read* 1 *l.* 17 *s.* 05 *d.*

In the Sheet whose Signature at Bottom is D d, and Article, *If a Wall be* 104 *Feet* 9 *Inches*, &c. mind not the working in that Page but this which follows.

```
        104—9
         17—3
        ─────
        728
       104
         12—9
         26—2—3
      ──────────────
  272 )1806—11—3( 6
       1632
   68) 174( 2
       136
       ───
        38
```

Answer, Six Rods ½ 38 Foot, 11 Inches, 3 Parts.

N. B. We hope the Reader will make all proper Allowances in the Prices; as better Workmanship or Materials may exceed the Schemes of our Computations.

F I N I S.

Place this at the End of the Second VOLUME.

ERRATA.

IN the Article of the *Straight Arch*, Fig. II. Line 12. for the Opening of the Compasses A G, *&c.* *read* the Opening of the Compasses A C, *&c.*

In the Explanation of Plate I. Fig. I. in the Article of *Bridges* for A O, O P, and L M, prolonged in on P M, in S, *&c.* *read* A O, O P, and P M, prolonged to S; so that M S may be equal to P M. Let fall a Diameter, *&c.*

In the first Article of the Demonstration of Fig. I. Plate 1. in the Word *Bridges*, for counter-balanced by A G, *read* Counter-balanced by A C,

Article *Bridges*, instead of IX. Plate 11. *read* Fig. I. Plate 2.

In the Article *Cornishes* the Price is put much too cheap: The Reader must Allow for better Work and Materials; 'tis impossible to be exact.

Under the Letters G, I, and the Name of *Girders* and *Summers*, in the Table of the Dimensions of their Scantlings, the Titles at the Head of the two last Columns of the Table, which are *Feet*, should be *Inches*.

Mistakes in the Directions for placing the Cuts, which the Binder must correct.

Plate XXIII. to be placed in Vol. I. at the End of Sheet F f, facing *Hips*.
Plate XXVII. in Sheet P, Vol. II. facing *Rudenture*.
Plate XXVIII. in Sheet S, Vol. II. facing *Steps*.

Directions for the [illegible] of the [illegible] Volume.

ERRATA.

IN the [illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible] the Contents [illegible] [illegible] the Ordering of the Contents [illegible]

In the Explanation of [illegible] [illegible] [illegible] for A C — [illegible] [illegible] [illegible] read [illegible] and [illegible] [illegible] that M [illegible] equal [illegible] [illegible]

In the [illegible] Article [illegible] [illegible] [illegible] [illegible] the Word [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

Article [illegible] [illegible] Place [illegible] [illegible] till the [illegible] [illegible] for the [illegible] is not [illegible] [illegible] [illegible] Reader must [illegible] for better Work and [illegible] [illegible] to be [illegible]

Under the [illegible] [illegible] and the Name of [illegible] and [illegible] in the [illegible] of the [illegible] of their [illegible] [illegible] the [illegible] the [illegible] [illegible] [illegible] Columns of [illegible] [illegible] [illegible] should be [illegible]

[illegible] [illegible] [illegible] Cuts [illegible] [illegible]

Plate [illegible] [illegible] [illegible] [illegible] at the [illegible] [illegible]
[illegible]
Plate [illegible] [illegible] [illegible] [illegible]
Plate [illegible] [illegible] [illegible] [illegible]